Post-Dredge Subsurface Sediment Characterization and Sand Cover Monitoring Report

Port of Seattle
Seattle, Washington
Terminal 115, Berth 1

Prepared for:

Port of Seattle
2711 Alaskan Way
Seattle, WA 98121

Prepared by:

Science and Engineering for the Environment, LLC
4401 Latona Ave NE
Seattle, WA 98105

June 25, 2010

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1. INTRODUCTION

This document reports the methods and results of bathymetric surveys, sediment sampling and sediment analysis conducted in support of the Port of Seattle's Terminal 115 (T-115) Berth 1 maintenance dredging and pier replacement project. Terminal 115 required maintenance dredging to re-establish adequate depth to accommodate barge loading and unloading. The required project dredge depth is -16.5 feet (ft) mean lower low water (MLLW) with 2 ft of allowable overdepth. The overdredge depth allows for the placement of a 1-foot (ft) (minimum thickness) layer of clean sand over the sediments exposed by dredging.

Construction monitoring was required as a condition of the U.S. Army Corps of Engineers (USACE) Permit Number NWS-2008-1496-WRD. Two specific sampling plans governed the conduct of sampling at T-115:

- *Post-Dredge Subsurface Sediment Characterization Quality Assurance Program Plan* (Anchor-QEA 2009a)
- *Sand Cover Monitoring Plan* (Anchor-QEA 2009b).

Sediment sampling was conducted by Science and Engineering for the Environment (SEE), LLC of Seattle WA with support provided by Browning Environmental Services of Olympia, WA and Marine Sampling Services of Burley, WA. Laboratory analyses were conducted by Columbia Analytical Systems of Kelso, WA; data validation was conducted by Pyron Environmental of Olympia, WA.

Bathymetric surveys were also required by the *Sand Cover Monitoring Plan* to verify that the target thickness of cap material was placed over the dredged area. Those surveys were conducted by the Port of Seattle Engineering Department. Bathymetric surveys were conducted prior to and at the conclusion of maintenance dredging, and after placement of the sand cover.

1.1 PROJECT DESCRIPTION

T-115 is located at 6700 West Marginal Way Southwest in the City of Seattle on the west bank of the Duwamish River (Figure 1-1). The site is situated in the joint Model Toxics Control Act (MTCA)/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Lower Duwamish Waterway Group (LDWG) Superfund Site (Port of Seattle 2009).

Major construction activities at the T-115 facility included:

- Removal of the existing wooded pier
- Installation of a sheet pile wall
- Dredging to -16.5 ft MLLW to accommodate barge berthing
- Installation of 48-inch piles
- Installation of a minimum 1-ft thick sand cover over the sediment surface exposed by dredging.

The in-water construction activities occurred from December 2, 2009 through February 23, 2010. Dredging occurred between January 20 and February 12, with sand cover placement beginning on February 20 and concluding on February 23, 2010. The brief hiatus between conclusion of dredging and placement of sand cover occurred to allow confirmation of final dredge depths with bathymetric surveys, and to allow for the collection of post-dredge sediment sampling. Construction activities at the site, and associated water quality monitoring and hydroacoustic monitoring may be found in previously submitted T-115 reports (SEE 2010, GRS and SEE 2010).

1.2 POST-DREDGE SUBSURFACE SEDIMENT CHARACTERIZATION

As part of USACE's coordination with U.S. Environmental Protection Agency (EPA) and Washington State Department of Ecology (Ecology) the Port agreed to collect cores after completion of dredging activities. The specific objective of the post-dredge subsurface sampling included:

- Collection of subsurface sediment cores at four locations within the post-dredge footprint of the T-115 dredging prism after the conclusion of maintenance dredging to characterize sediments that were exposed by dredging as well as the vertical distribution of chemicals in the sediment column down to 4 ft below mudline
- Analysis of four 1-ft intervals from each core in accordance with the Dredged Material Management Program (DMMP) guidelines for polycyclic aromatic hydrocarbon (PAH) compounds, polychlorinated biphenyls (PCBs), semivolatile organic chemicals (SVOCs), and dioxin and furan congeners
- Comparison of the chemical results against the DMMP interpretive criteria.

The methods and results for the post-dredge characterization are presented in Section 2.

1.3 SAND COVER MONITORING

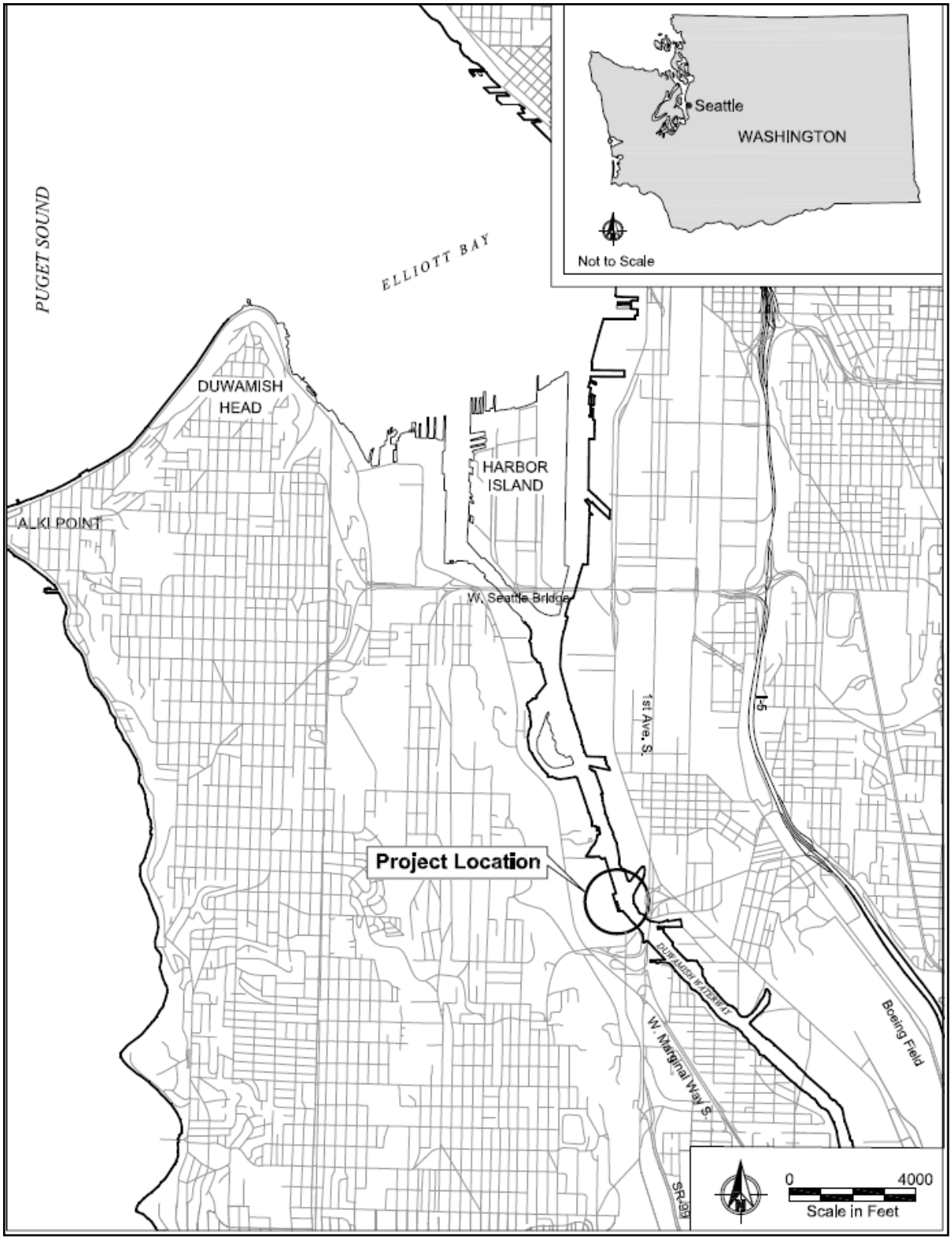
The Corps permit also required that the Port place a 1-ft sand cover over the entire dredged area, and undertake a three-year monitoring program of the cover at T-115. The objectives of the baseline (post-placement) monitoring event reported herein include:

- Pre- and post sand cover placement bathymetric surveys to verify that the minimum 1-ft thickness is achieved.
- Chemical analyses of the sand pre-placement and sand cover samples collected after placement to establish baseline surface chemical concentrations and to confirm that minimal mixing of the sand cover with the underlying subsurface sediment occurred during sand cover placement. Chemical analyses and interpretation of the results follow both the DMMP and Washington State Sediment Management Standards (SMS) (WAC 173-204).

Longer-term monitoring will include 1) bathymetric surveys conducted at 6 months, 1 year, and 3 years following cover placement; 2) sediment samples taken again at years 1 and 3; and 3) a study of recontamination potential from storm drain discharges near the T-115 sand cover.

A separate *Recontamination Study Work Plan* (TEC and SEE, 2010) was submitted to the Port, EPA and Ecology in March 2010. The work plan describes procedures for collecting and processing of storm drain sediment samples from the storm drain systems at T-115 that drain into Berth 1. This project will collect and analyze sediment trap and sediment grab samples from the storm drain systems that discharge directly adjacent to Berth 1 at T-115. The resultant data will subsequently be used to evaluate the potential for recontamination of the clean sand cover placed on the maintenance dredged area in Berth 1 in the year following cover placement to observe changes to chemical concentrations over time.

Figure 1-1 Port of Seattle Terminal 115 Vicinity Map (adapted from the Sediment Cover QAPP)



2. BATHYMETRIC SURVEY RESULTS

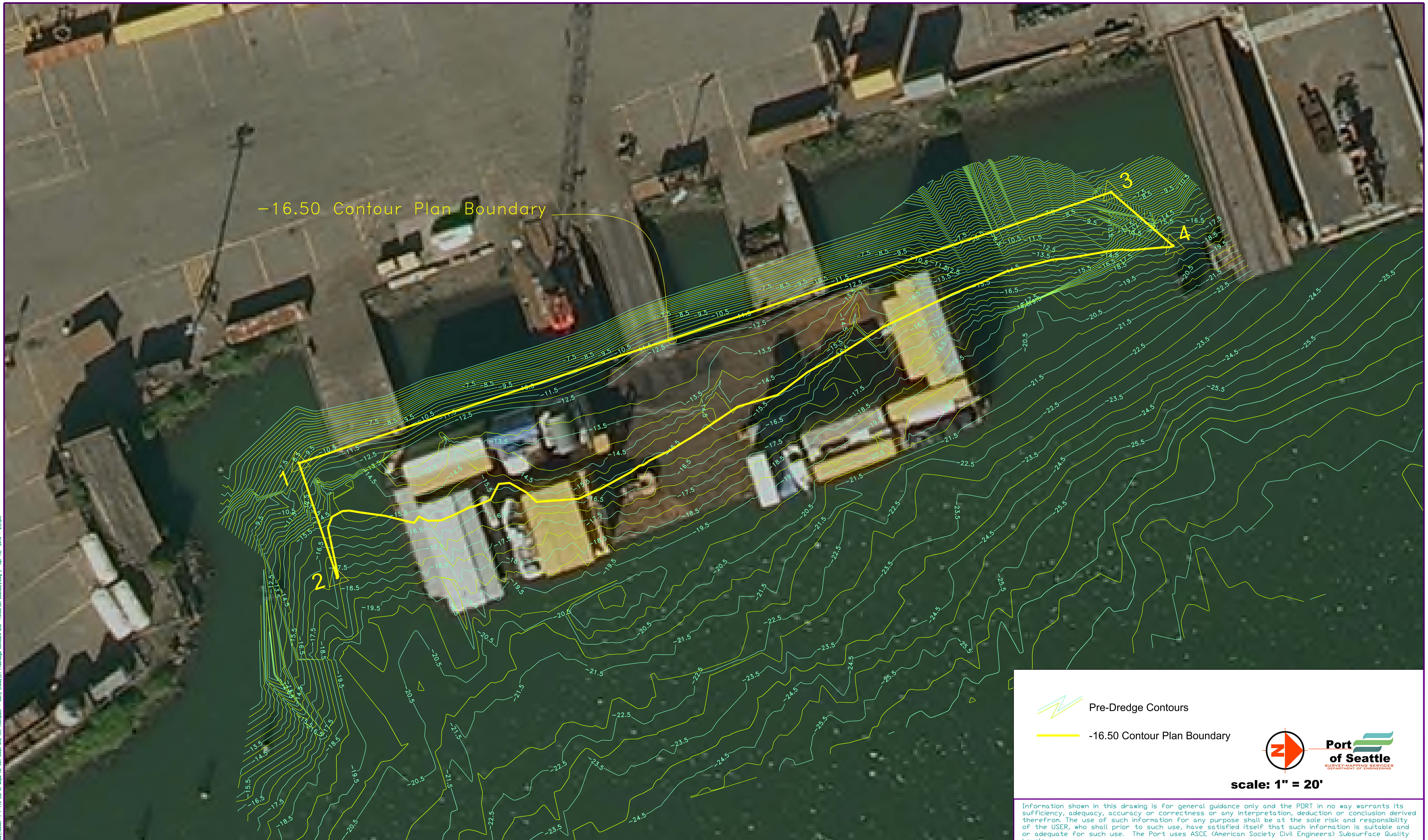
Bathymetric surveys were conducted by the Port of Seattle Engineering Department throughout the T-115 Berth 1 construction activities. The purpose of the surveys was to confirm post-dredging and post-sand cover placement depths. The surveys were conducted using a Ross Model 960 Hydrographic Survey System and Trimble DSM GPS receiver integrated with HYPACK 2009 survey and data acquisition software. Water depth measurements taken with the Ross 960 Hydrographic System were supplemented with lead line measurements. The survey results are presented in the North American Datum, 1983 and elevations are referenced to MLLW.

HYPACK 2009 was used to process the single-beam data from the Ross 960. Tide elevations, times, and corrections were applied prior to editing data. Processed survey data was then reduced and defined to produce data in a 20-ft trackline interval. The data was then brought into Liscad v.8, Survey and Engineering Software, in which a preliminary Digital Terrain Model (DTM) was created and checked for uniformity and quality. In addition, the DTM was compared to previous surveys for accuracy and consistency.

The pre-dredge survey was conducted on 1 December 2009, post-dredge surveys were conducted from 25 January 2010 through 19 February 2010, and the post-sand cap survey was conducted from 23-25 February 2010. Multiple survey events were conducted during the port-dredging phase to ensure that project depths were met and due to debris encountered in the northern portion of the survey area.

Figure 2-1 shows the pre-construction contours. The overall goal of the dredging program was to have -16.5 ft. MLLW depth after placement of the 1-ft sand cover. Bucket prints are shown in Figure 2-2, showing where the mechanical dredge bucket cuts were taken. The final post-dredge depth is shown in Figure 2-3; generally the post-dredge depths within the -18 ft. or deeper. Given that the dredge bucket footprint extended outside of the original project line (Figure 2-3), a new sand-cover placement boundary was developed by the Port of Seattle Environmental Manager, Jon Sloan. Figure 2-4 shows the locations that sand placement buckets were placed over the entire project area. The final post-placement site bathymetry is shown in Figure 2-5, and Figure 2-6 presents the post-placement cover thickness. For most of the site, the cover thickness exceeded 1 ft. A few areas proximal to the sheet pile wall on the shore-side were less than 1 ft; this was likely due to difficult access for the placement equipment.

Complete bathymetric survey results from the Port of Seattle are provided in Appendix A.



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PROJECT: TERMINAL 115

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Pre-Dredge Buckets

-16.50 Contour Plan Boundary

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SHEET TITLE: T-115 Sand Cap Buckets, Sand Cover Boundary and -16.5 Contour Plan Boundary

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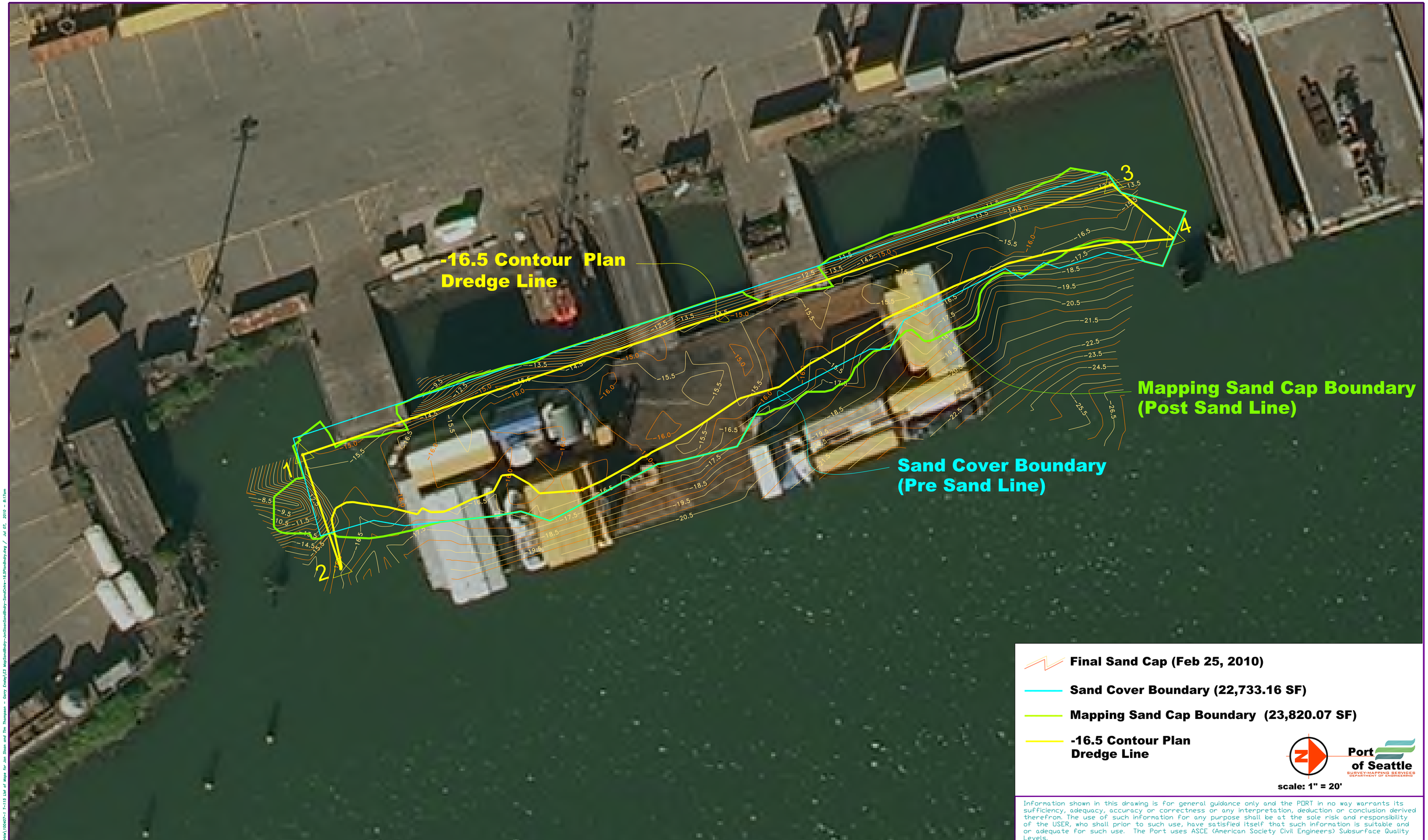

Final Sand Cap (Feb 25, 2010)

Sand Cover Boundary (22,733.16 SF)

Mapping Sand Cap Boundary (23,820.07 SF)

-16.5 Contour Plan
Dredge Line

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Site: Sand Cap Corrected
Stratum: Sand Cap Corrected
Surface 1: 100218-1 t-115 final post modmar16nobndr (NO SET BOUNDARY LIMIT)
Surface 2: 100218-1 t-115 Final-Modified Sand Cap (NO SET BOUNDARY LIMIT)

Volume
1,357.90 (CF) End area

Sand Cover Boundary

Beetween Post Dredge Surface and Sand Cap Surface

+99.9 Fill Tick Mark (at every 5ft)

- 99.9 Cut Tick Mark (at every 5ft)

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SHEET TITLE: T-115 Post Dredge to Final Sand Surface including Fill and Cut Tick Marks

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3. TERMINAL 115 POST-DREDGE SUBSURFACE SEDIMENT CHARACTERIZATION

The purpose of sediment sampling after the conclusion of maintenance dredging was to characterize the chemical composition of the sediments exposed by dredging to the -16.5 MLLW project depth (with 2 ft of allowable overdredge) as well as to provide information on the vertical distribution of chemicals within the sediment column. Post-dredge sampling was conducted as part of USACE's multi-agency coordination with EPA and Ecology for projects within the Lower Duwamish Waterway joint MTCA / CERCLA site.

3.1 METHODS

3.1.1 Sediment Collection

Sediment collection and laboratory analyses for the post dredge survey were conducted in accordance with the *Quality Assurance Project Plan* (QAPP) (Anchor QEA 2009a). Notable variances from the QAPP that occurred during the sampling are detailed in the following.

Initial post-dredge subsurface sediment sampling occurred on 27 January 2010 and was conducted by SEE LLC of Seattle, WA and Marine Sampling Services (MSS) of Burley, WA. SEE was the project leader and MSS provided vessel, navigation and vibracoring services. Additional coring for post-dredge subsurface sediment characterization occurred on 10 March 2010 and was conducted by the same personnel as the first event. The field logs from both coring events are presented as Appendix B.

3.1.1.1 Sample Locations

The target locations of post-dredge coring were prescribed in the QAPP and were based on a projected dredge area calculated from bathymetric data and project design at the time when the QAPP was written. Post-dredge core locations (SC) and post-cover surface sediment (SG) locations for which chemical analyses were conducted are shown in Figure 3-1. The stations collected in the southern portion of the dredge area (SC-01 and SC-02) were close to those prescribed in the QAPP. For the northern stations (SC-03 and SC-04), a field-decision was made to locate both further east from the QAPP-designated locations. This was due to the inability, after multiple attempts, to core to the QAPP-specified collection depth of -6 ft. below mudline; both construction activities and seafloor debris interfered with core collection. After consultation with the Port, those stations were moved eastward and then successfully collected.

After collection of the sediment cores on 27 January 2010 and receipt of final post-dredge bathymetry, it was determined that Stations SC-03 and SC-04 were either on the border or outside the verified dredge area. As a result, these stations were relocated and sampled again at the time of the post-sand placement survey on 10 March 2010.

Throughout coring activities, a Trimble differential global positioning unit that used the U.S. Coast Guard differential correction was used. The DGPS was interfaced to an integrated navigation system that displayed the vessel position relative to target location and shoreline

features in real time. Coordinates were recorded electronically and in the field log when the corer reached the bottom.

3.1.1.2 Core Collection

All subsurface sediment samples were collected aboard the MSS's *MV Nancy Ann* using a hydraulically-powered vibracore, which met the criteria set for sample collection as prescribed in the QAPP. As stated in the QAPP, subsurface sediment samples were to be collected to a depth of 6 ft below post-dredge mudline, sectioned into 1-ft segments and then homogenized for analysis. For the post-dredge subsurface sediment sampling, the vibracoring device was outfitted with 4-inch outer-diameter (OD), pre-cleaned aluminum core tubes that were 8 ft in length. Based on the core tube length and corer geometry, a 7-ft drive length was anticipated in order to collect the desired 6 ft of sediment. Table 3-1 shows the cores collected, times, location and pertinent drive and recovery information for sediment cores collected as part of the post-dredge subsurface sediment characterization. Additional information regarding the collection of cores can be found in the field log (Appendix B).

Once collected, all cores were measured and then cut, covered with aluminum foil and capped in the field into segments of 4 ft or less for subsequent logging and processing. After segmenting, all cores were kept on ice until processing.

3.1.1.3 Sample Collection Deviations from QAPP

Notable deviations from the collection procedures outline in the QAPP (Anchor QEA 2009) and their reasons and rationale follow.

Although 6 ft of sediment core was targeted in the QAPP as the collection goal, at only one station (SC-02) was enough core length collected to produce samples representing all depth intervals to -6 ft below mudline. The top 5 ft of the sediment column was collected at SC-01 and the top 4 at SC-03 and SC-04. For each sampling location where less than 6 ft of sediment was retained, multiple coring attempts were made and the core was either driven to full travel length (7 ft) or to refusal.

Stations SC-03 and SC-04 were located at the edge or slightly outside the verified dredged area during the first sediment coring event (January 2010). After consultation with EPA and Ecology, it was agreed that additional samples within the dredged footprint would be collected. These samples were named SC-032 and SC-042 and were collected at the time of the post-sand cover placement survey. Post-dredge samples for the cores collected at these two stations began at the sand cover/sediment interface, and proceeded to the bottom of the core.

Table 3-1 Post-Dredge Subsurface Sediment Characterization Sampling Stations and Cores Collected

Station	Date	Time	Latitude	Longitude	Depth to Dredged Mudline (MLLW)	Sample Type	Drive Length	Recovery
SC-01	1/27/2010	10:30	47 32.6404N	122 20.2812W	-17.6	4-inch OD Vibracore	7 ft	5 ft
SC-02	1/27/2010	11:11	47 32.6536N	122 20.2867W	-17.3	4-inch OD Vibracore	7 ft	5.67 ft
SC-03	1/27/2010	12:14	47 32.6752N	122 20.2993W	-17.7	4-inch OD Vibracore	7 ft	4.92 ft
SC-04	1/27/2010	14:32	47 32.6797N	122 20.3074W	-20.6	4-inch OD Vibracore	7 ft	4.75 ft
SC-03-2	1/27/2010	12:14	47 32.6697N	122 20.3019W	-17.1	4-inch OD Vibracore	7 ft	4.6 ft
SC-04-2	1/27/2010	13:59	47 32.6901N	122 20.3128W	-15.8	4-inch OD Vibracore	7 ft	4.9 ft

During the resampling of station SC-042, two cores were retained in the event that additional sample volume would be needed. The core with the best recovery was selected to be the primary sample and the other core would be processed only if additional sediment was required to obtain sufficient volumes for analyses. Sufficient sediment was obtained from the selected core and the remaining core was to be logged, photographed and discarded. Due to the sub-sand cover sediment showing visible signs of contamination and being markedly different from that sampled as SC-042, the Port decided to analyze the 1 ft of post-dredge, non-sand cover sediment. This sample is reported as SC-043.

3.1.2 Sample Processing

Sample processing of cores collected as part of the post-dredge subsurface sediment characterization was conducted in accordance with the procedures prescribed in the QAPP (Anchor QEA 2009). Cores were cut longitudinally, split, photographed and logged prior to subsampling. Core logs from processing are presented in Appendix C. Photographs of each core are presented in Appendix D. All samples collected and their disposition is presented in Table 3-2.

During processing, cores were subsampled into 1-ft intervals (e.g., 0-1ft, 1-2 ft, 2-3 ft, and 3-4 ft, etc.) measured from mudline as prescribed in the QAPP. The sediment from each 1 ft segment was homogenized and then placed into pre-cleaned, labeled sample jars, logged in the chain of custody form and kept on ice up to and through delivery to the analytical laboratory. The uppermost four 1-ft units (0-1 ft, 1-2 ft, 2-3 ft and 3-4 ft below mudline) were submitted for laboratory analyses and the remaining two segments (4-5 and 5-6 ft below mudline) were archived for possible future analysis. All samples were submitted to Columbia Analytical Systems of Kelso, WA for analysis and archiving. Chain of custody documentation is presented as Appendix E.

3.2 RESULTS

The samples from the uppermost 4 ft of the sediment column were submitted Columbia Analytical Services for chemical and conventional analyses specified in the QAPP. Post-dredge subsurface sediment chemistry results are provided in Appendix F and full results are presented in Appendix G. All sediment chemistry data underwent a Tier IV validation that was conducted by Pyron Environmental of Olympia, WA. Validation reports for each sample batch are presented in Appendix H.

Sediment chemistry results were compared the DMMP Screening Level and Maximum Level criteria as specified in the QAPP (Anchor 2009a). In addition, dioxin and chlorinated furans were compared to the 2010 DMMP interim criteria for these compounds using toxicity equivalent quotients (TEQ). TEQ were calculated using the methodology outlined in the DMMP User Manual (USACE 1998). As prescribed in that document, dioxin and chlorinated furan congener TEQ summations are reported separately when non-detected congeners are not used in the summation and for when one-half of the reporting limit for non-detected analytes are used in the summation.

Table 3-2 Post-Dredge Sediment Samples and Analyses

Station	Interval	Collection Interval (ft)	TVS, TOC	Grain Size	PCBs	PAHs GC/MS SIM	Dioxins	Archive
T115-**SC-01**-100127	ZA	0 - 1	✓	✓	✓	✓	✓	
	ZB	1 - 2	✓	✓	✓	✓	✓	
	ZC	2 - 3	✓	✓	✓	✓	✓	
	ZD	3 - 4	✓	✓	✓	✓	✓	
	ZE	4 - 5						✓
T115-**SC-02**-100127	ZA	0 - 1	✓	✓	✓	✓	✓	✓
	ZB	1 - 2	✓	✓	✓	✓	✓	✓
	ZC	2 - 3	✓	✓	✓	✓	✓	✓
	ZD	3 - 4	✓	✓	✓	✓	✓	✓
	ZE	4 - 5						✓
	ZF	5 - 5.7						✓
T115-**SC-03**-100127	ZA	0 - 1	✓	✓	✓	✓	✓	✓
	ZB	1 - 2	✓	✓	✓	✓	✓	✓
	ZC	2 - 3	✓	✓	✓	✓	✓	✓
	ZD	3 - 4	✓	✓	✓	✓	✓	✓
	ZE	4 - 4.9						✓
T115-**SC-04**-100127	ZA	0 - 1	✓	✓	✓	✓	✓	✓
	ZB	1 - 2	✓	✓	✓	✓	✓	✓
	ZC	2 - 3	✓	✓	✓	✓	✓	✓
	ZD	3 - 4	✓	✓	✓	✓	✓	✓
	ZE	4 - 4.8						✓

Table 3-2 Post-Dredge Sediment Samples and Analyses

Station	Interval	Collection Interval (ft)	TVS, TOC	Grain Size	PCBs	PAHs GC/MS SIM	Dioxins	Archive
T115-**SC-03**-2-1003210	ZA	0 - 1	✓	✓	✓	✓	✓	✓
	ZB	1 - 2	✓	✓	✓	✓	✓	✓
	ZC	2 - 3	✓	✓	✓	✓	✓	✓
	ZD	3 - 3.7	✓	✓	✓	✓	✓	✓
T115-**SC-04**-2-100310	ZA	0 - 1	✓	✓	✓	✓	✓	✓
	ZB	1 - 2	✓	✓	✓	✓	✓	✓
	ZC	2 - 3	✓	✓	✓	✓	✓	✓
	ZD	3 - 4	✓	✓	✓	✓	✓	✓
T115-**SC-04**-3-100310	ZA	0 - 1	✓	✓	✓	✓	✓	✓

All analytical results are reported and screened against DMMP criteria (Appendix F). Results are discussed by station.

3.2.1 Station SC-01

For SC-01, five 1-ft collection intervals were collected; four were analyzed per the work plan (ZA – ZD) and one was archived (ZE). Detected chemicals that exceed the DMMP criteria are presented in Table 3-3. Complete results for this station may be found in Appendix Table F-1.

At Station SC-01, total PCBs exceeded DMMP screening level criteria in all four depth intervals (ZA-ZD) (Table 3-3). Other detected compounds that exceeded screening levels were fluoranthene, pyrene and total high molecular weight PAHs (HPAH) in the SC01-ZD (3-4 ft below mudline) sample interval. Although total HPAH did not exceed the screening level in any sample interval, total HPAH did exceed the bioaccumulation trigger in the SC01-ZC and SCO1-ZD strata.

Dioxins and chlorinated furans were compared to two DMMP criteria: the 4 TEQ guideline for open water disposal of dredged material at a dispersive site; and 10 TEQ, the maximum concentration of a dredged material management unit (DMMU) that can be disposed of at a non-dispersive site with the additional requirement that the weighted average of the volume of all dredged material placed at the non-dispersive site does not exceed 4 TEQ. The TEQ calculations are calculated and presented in two ways: 1) where the non-detected values are not included in the TEQ total; and 2) the non-detected compounds are included in the TEQ total at one-half the Reporting Limit (RL). The TEQ guidelines were not exceeded in the surface (ZA) layer, but exceeded the 10 TEQ in the next two intervals (ZB and ZC) and the 4 TEQ in the lowest interval (ZD).

Table 3-3 Station SC-01 Detected Compounds Exceeding DMMP Criteria

Chemical Dry Weight	SC01-ZA 0 – 1 ft	SC01-ZB 1 – 2 ft	SC01-ZC 2 – 3 ft	SC01-ZD 3 – 4 ft
Fluoranthene (µg/kg)	—	—	—	2,700 (SL)
Pyrene (µg/kg)	—	—	—	2,600 (SL)
Total HPAH (µg/kg)	—	—	4,733 (BT)	8,236 (BT)
Total PCB (µg/kg)	330 (SL)	333 (SL)	590 (SL)	425 (SL)
Total Dioxins (TEQ)	—	20.2 (10 TEQ)	24.0 (10 TEQ)	6.4 (4 TEQ)
Total Dioxins ½ RL (TEQ)	—	20.6 (10 TEQ)	24.4 (10 TEQ)	6.7 (4 TEQ)

Notes:
SL=Screening Level
ML=Maximum Level
BT = Bioaccumulation Trigger
TEQ = Toxicity Equivalent Quotient
Concentrations are reported in µg/kg dry weight

There were several compounds that were non-detected but their reporting limits exceeded DMMP screening criteria. For SC-01, those compounds are listed in Table 3-4. A discussion of the elevated detection limits for these compounds is presented in Section 3.3.

Table 3-4 Station SC-01 Non-detect Compounds Exceeding DMMP Criteria

Chemical	SC01-ZA 0 – 1 ft	SC01-ZB 1 – 2 ft	SC01-ZC 2 – 3 ft	SC01-ZD 3 – 4 ft
1,2-Dichlorobenze	—	—	—	67 U (SL)
1,2,4-Trichlorobenzene	—	—	—	67 U (ML)
Butyl Benzyl Phthalate	—	—	—	67 U (SL)
N-Nitrosodiphenylamine	—	—	—	67 U (SL)
2-Methylphenol	—	—	—	67 U (SL)
2,4-Dimethylphenol	48 U (SL)	—	200 U (SL)	340 U (ML)
Pentachlorophenol	—	—	390 U (SL)	670 (SL)
Benzyl Alcohol	—	—	78 U (SL)	140 U (SL)
Benzoic Acid	—	—	780 U (SL)	1400 U (ML)

Notes:
SL=Screening Level
ML=Maximum Level
Concentrations are reported in µg/kg dry weight

3.2.2 Station SC-02

For SC-06, six intervals were collected to 5.7 below mudline; four were analyzed per the work plan (ZA – ZD) and two are archived (ZE-ZF). Detected chemicals that exceed the DMMP criteria are presented in Table 3-5. Complete results for this station may be found in Appendix Table F-2.

The PCB SL was exceeded at the first, second and last sampling intervals (ZA, ZB and ZD). The SL for butyl benzyl phthalate was exceeded in the first two intervals (ZA and ZB), but was only detected in the second interval (ZB). The 4 TEQ threshold was exceeded at all four intervals, with the lowest interval (ZD) also exceeding 10 TEQ.

Table 3-5 Station SC-02 Non-detect Compounds Exceeding DMMP Criteria

Chemical	SC02-ZA 0 – 1 ft	SC02-ZB 1 – 2 ft	SC02-ZC 2 – 3 ft	SC02-ZD 3 – 4 ft
Butyl Benzyl Phthalate	—	100 D (SL)	—	—
Total HPAH (µg/kg)	—	—	—	5,381 (BT)
Total PCB (µg/kg)	349 (SL)	294 (SL)	—	214 (SL)
Total Dioxins (TEQ)	8.1 (4 TEQ)	6.3 (4 TEQ)	6.5 (4 TEQ)	10.1 (10 TEQ)
Total Dioxins ½ RL (TEQ)	9.4 (4 TEQ)	6.7 (4 TEQ)	5.9 (4 TEQ)	10.5 (10 TEQ)

Notes:
SL=Screening Level
ML=Maximum Level
BT = Bioaccumulation Trigger
TEQ = Toxicity Equivalent Quotient
Concentrations are reported in µg/kg dry weight

Non-detected chemicals from Station SC-02 that exceeded DMMP criteria are presented in Table 3-6.

Table 3-6 Station SC-02 Non-detect Compounds Exceeding DMMP Criteria

Chemical	SC02-ZA 0 – 1 ft	SC02-ZB 1 – 2 ft	SC02-ZC 2 – 3 ft	SC02-ZD 3 – 4 ft
1,2-Dichlorobenze	95 U (SL)	41 U (SL)	—	—
1,2,4-Trichlorobenzene	95 U (ML)	41 U (SL)	—	—
Dimethyl Phthalate	95 U (SL)	—	—	—
Butyl Benzyl Phthalate	95 U (SL)	—	—	—
N-nitrosodiphenyl-amine	95 U (SL)	41 U (SL)	—	—
2-Methylphenol	95 U (ML)	41 U (SL)	—	—
2,4-Dimethylphenol	480 U (ML)	210 U (ML)	42 U (SL)	42 U (SL)
Pentachlorophenol	950 U (ML)	410 U (SL)	—	—
Benzyl Alcohol	190 U (SL)	82 U (SL)	—	—
Benzoic Acid	1900 U (ML)	820 U (ML)	—	—

Notes:
SL=Screening Level
ML=Maximum Level
Concentrations are reported in µg/kg dry weight

3.2.3 Station SC-03

For SC-03 only four intervals were collected. Detected chemicals that exceeded the DMMP criteria for Station SC-03 are presented in Table 3-7. Complete results for this station may be found in Appendix Table F-3. As noted in the Methods section, Station SC-03 was resampled in March 2010 and was designated SC-032. Sample SC-03 was from the initial collections in January 2010; this SC-03 was processed and archived, but not analyzed (Table 3-2).

Total PCBs exceeded the SL in the first three intervals (ZA – ZC), but no PCB Aroclors were detected in the last depth interval (ZD). Other detected chemicals that exceeded the SL included butyl benzyl phthalate in the first interval (ZA). Measured levels of pyrene, benzo(a)anthracene, chrysene, and total HPAHs exceeded the SL in the second interval (ZB). The total 10 TEQ threshold was exceeded in the first two intervals (ZA, ZB), but was less than the 4 TEQ threshold for the third and fourth intervals (ZC and ZD). However, when one-half the reporting limit for non-detected dioxin/furans were included in the TEQ calculation for the lowest interval (ZD), the resultant TEQ was 6.7, exceeding the 4 TEQ threshold.

Table 3-7 Station SC-032 Detected Compounds Exceeding DMMP Criteria

Chemical	SC032-ZA 0 – 1 ft	SC032-ZB 1 – 2 ft	SC032-ZC 2 – 3 ft	SC032-ZD 3 – 4 ft
Butyl Benzyl Phthalate	69 D (SL)			
Pyrene		9,000 (SL)		
Benzo(a)anthracene		1,600 (SL)		
Chrysene		2,100 (SL)		
Total HPAH (µg/kg)		18,640 SL)		
Total PCB (µg/kg)	296.5 (SL)	302 (SL)	540 (SL)	—
Total Dioxins (TEQ)	13.7 (10 TEQ)	12.6 (10 TEQ)	—	0.0087
Total Dioxins ½ RL (TEQ)	14.1 (10 TEQ)	13.0 (10 TEQ)	—	6.7 (4 TEQ)

Notes:
SL=Screening Level
ML=Maximum Level
BT = Bioaccumulation Trigger
TEQ = Toxicity Equivalent Quotient
Concentrations are reported in µg/kg dry weight

Non-detected chemicals exceeding the DMMP criteria at Station SC-032 are presented in Table 3-8.

Table 3-8 Station SC-032 Non-detect Compounds Exceeding DMMP Criteria

Chemical	SC032-ZA 0 – 1 ft	SC032-ZB 1 – 2 ft	SC032-ZC 2 – 3 ft	SC032-ZD 3 – 3.7 ft
1,2-Dichlorobenze	42 U (SL)	72 U (SL)	—	—
1,2,4-Trichlorobenzene	42 U (SL)	72 U (ML)	—	—
Hexachlorobenzene	42 U (SL)	72 U (SL)	—	—
Dimethyl Phthalate	—	72 U (SL)	—	—
Butyl Benzyl Phthalate	—	72 U (SL)	—	—
N-nitrosodiphenyl-amine	—	72 U (SL)	—	—
2-Methylphenol	—	72 U (SL)	—	—
2,4-Dimethylphenol	—	360 U (ML)	—	29 U (SL)
Pentachlorophenol	420 U (SL)	720 U (ML)	—	—
Benzyl Alcohol	83 U (SL)	150 U (SL)	—	—
Benzoic Acid	830 U (ML)	1500 U (ML)	—	—

Notes:
SL=Screening Level
ML=Maximum Level
Concentrations are reported in µg/kg dry weight

3.2.4 Station SC-04

Detected chemicals that exceeded the DMMP criteria for Station SC-042 and SC-043 are presented in Table 3-9. As noted in the Methods section, due to a second collection of this sample, the second sample received the designation SC-042. The initial collection SC-04 was processed, archived, but not analyzed (Table 3-2). During the resampling of SC-04, two cores

were collected; the core with the greatest amount of recovery was used for sample SC-042. Sufficient sediment volume was obtained from this core sample to meet sample volume requirements. The core that became Sample SC-043 was originally retained in the event addition sample volume was needed for SC-042. Once volume requirements were met with the single core representing SC-042, the intent was to log the additional core for sand cover thickness and then discard. However, due to the dissimilarity to the pre-cover sediments in the other core, the small amount of post-dredge sediment from the second core was sampled and analyzed by the Port. Functionally, SC-042 and SC-043 are field duplicates of the same station. Complete results for this station may be found in Appendix Table F-4.

No analytes exceeded DMMP evaluative criteria from any depth strata sampled at SC-042. Only a few analytes were detected at concentrations above reporting limits. The sediments collected from all strata at SC-042 were gravels and sand (>98%) with minimal fines and this helped contribute to the low reporting limits for these samples. For Station SC-043, total PCBs exceeded the SL and total dioxins exceeded the 10 TEQ criteria.

Table 3-9 Station SC-042 and SC-043 Detected Compounds Exceeding DMMP Criteria

Chemical	SC042-ZA 0 – 1 ft	SC042-ZB 1 – 2 ft	SC042-ZC 2 – 3 ft	SC042-ZD 3 – 4 ft	SC043-ZA 0 – 1 ft
Total PCB (µg/kg)	—	—	—	—	203 (SL)
Total Dioxins (TEQ)	0	0	0	0	35.5 (10TEQ)
Total Dioxins ½ RL (TEQ)	7.6 (4TEQ)	6.4 (4TEQ)	6.4 (4TEQ)	6.2 (4TEQ)	35.9 (10TEQ)

Notes:
SL=Screening Level
ML=Maximum Level
BT = Bioaccumulation Trigger
TEQ = Toxicity Equivalent Quotient
Concentrations are reported in µg/kg dry weight

3.3 DATA QUALITY AND LABORATORY PERFORMANCE

All data were subjected to a Tier IV validation conducted by Pyron Environmental. Data validation reports are presented as Appendix G. The validation reports detail laboratory performance and results against al QC criteria outlined in the QAPP. This section discusses the overall performance and usability of post-dredge sediment data as well as stating where results and performance differed from the QAPP.

Post-dredge sediment samples were submitted to the laboratory in two separate groups due to the resampling of two stations (Section 3.1). Data validation reports were generated for each submission (batch).

For the samples collected in January 2010, holding times, instrument performance checks, calibrations, calibration verification, surrogate recoveries, matrix spike and matrix spike duplicates, and laboratory reporting limits were within control parameters outlined by the QAPP and methodologies specified in the QAPP for GCMS and HRGC/HRMS analyses.

Data that was qualified as a result of the validations include:

- Aroclor 160 being qualified as an estimated (J) concentration at SC01-ZA, SC01-ZB, SC01-ZC, SC01-ZD, SC02-ZA, SC02-ZB, SC0D-ZC and SC02-ZD because the matrix spike and matrix spike duplicate samples percent recoveries were less than lower control limits.
- Octochlorodibenzo-p-dioxin values for SC01-ZB and SC01-ZC were qualified as estimates (J) due to the reported value exceeding the calibration range.
- Dimethyl phthalate concentrations for SC01-ZA, SC01-ZB, SC01-ZC, SC02-ZB, SC0D-ZC and SC02-ZD were changed from estimated (J) values to non-detected values (U) due to detection of dimethyl phthalate in the method blank.

For the laboratory analyses conducted on samples collected in March 2010, holding times, instrument performance checks, calibrations, calibration verification, surrogate recoveries, matrix spike and matrix spike duplicates, and laboratory reporting limits were within control parameters outlined by the QAPP and methodologies specified in the QAPP for GCMS and HRGC/HRMS analyses. In addition, a field duplicate sample was collected from SC032-ZA and assigned a sample ID of SC0532-ZA. Duplicate results and RPD calculations are presented in the Validation Report (Appendix H).

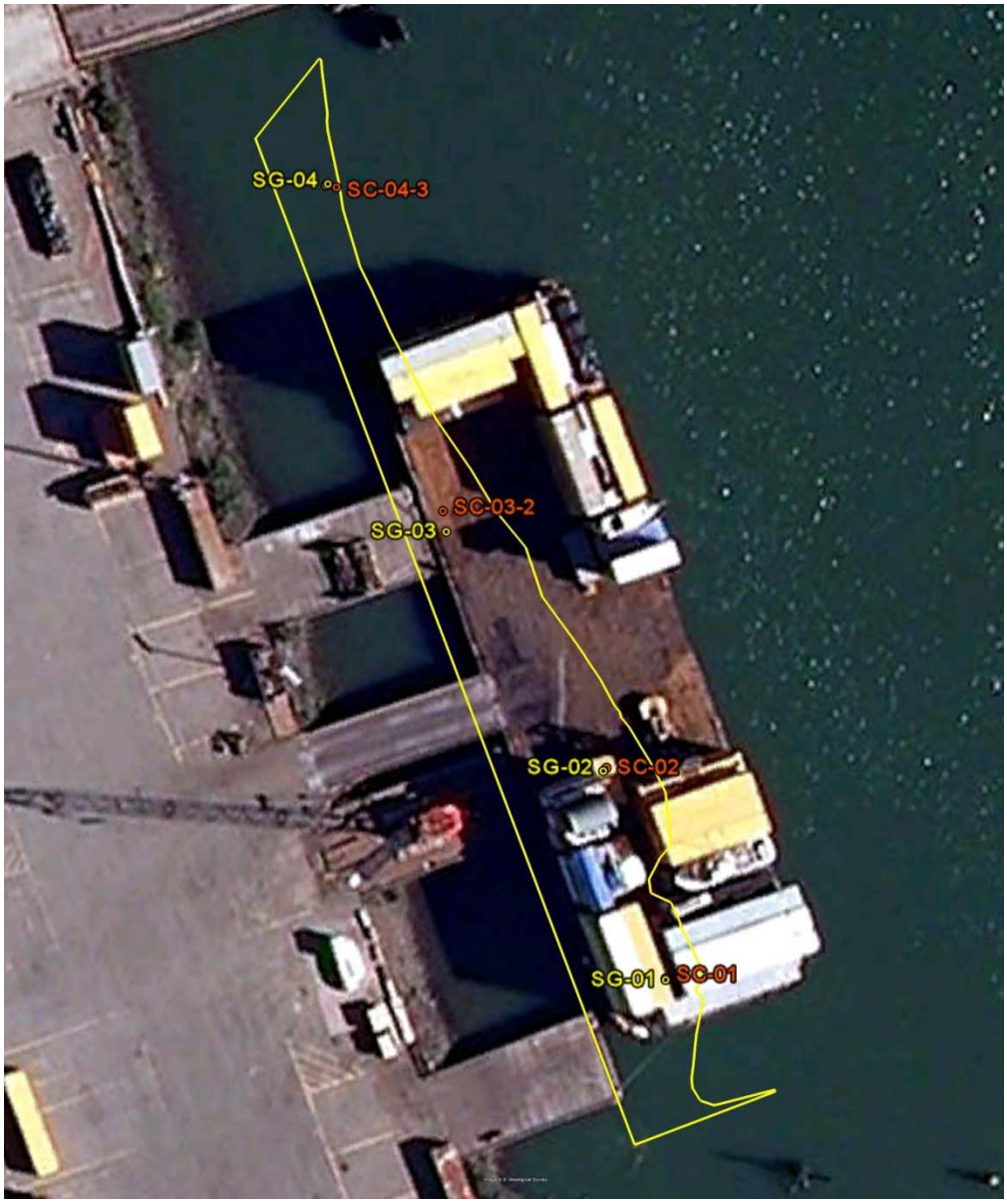
Data that was qualified due to laboratory or duplicate results that exceeded the criteria in the QAPP include:

- Octochlorodibenzo-p-dioxin values for SC0532-ZA and SC043-ZA were qualified as estimates (J) due to the reported value exceeding the calibration range.
- 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD) values for SC032-ZA, SC0532-ZA were qualified as estimates (J) due to field duplicate results being outside the precision criteria outlined in the QAPP.
- Octochlorodibenzo-p-dioxin values for for SC032-ZA, SC0532-ZA were qualified as estimates (J) due to field duplicate results being outside the precision criteria outlined in the QAPP.
- Dimethyl phthalate concentrations for SC032-ZA, SC032-ZB, SC032-ZC, SC0532-ZA and SC043-ZA were changed from estimated (J) values to non-detected values (U) due to detection of dimethyl phthalate in the method blank.
- 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD) concentrations for SC032-ZD, SC042-ZA, SC042-ZC, and SC042-ZD were changed from estimated (J) values to non-detected values (U) due to detection in the method blank.
- Octochlorodibenzo-p-dioxin concentrations for SC042-ZA, SC042-ZB, SC042-ZC, and SC042-ZD were changed from estimated (J) values to non-detected values (U) due to detection in the method blank.

- 1,2,3,4,6,7,8,-Heptachlorodibenzofuran concentrations for SC032-ZD, SC042-ZA, SC042-ZB, and SC042-ZC were changed from estimated (J) values to non-detected values (U) due to detection in the method blank.
- Octochlorodibenzofuran concentrations for SC032-ZD and SC042-ZB were changed from estimated (J) values to non-detected values (U) due to detection in the method blank.

As shown in Tables 3-2 through 3-9, several compounds were not detected in post-dredge surface and subsurface sediments, but the reporting limits for these compounds exceeded the corresponding DMMP screening level for that compound. Samples that showed elevated reporting limits were those that had either a high proportion of fines or sufficient amounts of PAH such that the extract required dilution. Although the there were several high reporting limits, all data was deemed usable with the aforementioned qualifications based on the data validation.

Figure 3-1 Post-dredge Sediment Core (SC) and Post-cover Sediment Grab (SG) Sample Locations



4. SAND COVER MONITORING

The purpose of the sand cap sampling was to ensure that the sand substrate placed over the exposed dredged material was free of chemical contamination pre-placement, and to establish baseline chemical conditions post-placement. Additionally, sediment samples collected from the interim sand cover were also evaluated to ascertain if the desired cover thickness was achieved (1 ft) and whether any mixing between sand cover materials and dredge residuals or site sediments occurred. This sampling event was the first event in a three-year monitoring effort of the sand cover placed at T-115.

4.1 METHODS

Sediment collection and laboratory analyses for the sand cover survey were conducted in accordance with the *Quality Assurance Project Plan* (QAPP) *Port of Seattle Terminal 115 Post Dredge Subsurface Sediment Characterization* (Anchor QEA 2009). Notable variances from the QAPP that occurred during the sampling are detailed below.

Sediment collections for sand cover monitoring occurred on 10 March 2010 and were conducted by SEE LLC of Seattle, WA and Marine Sampling Services (MSS) of Burley WA. SEE was the project leader and MSS provided vessel support and navigation services. The field logs are presented as Appendix B.

4.1.1 Pre-placement Sand Source and Chemical Analysis

Sand cover material was obtained by the construction contractor, Pacific Pile and Marine, Inc. (Pacific) from Glacier Northwest's sand and gravel quarry on Vashon Island. Chemical analysis of the sand was directed by Anchor-QEA and the data supplied to the Port of Seattle. The results of the chemical analyses of the sand cover are presented in Appendix I. For SVOCs analyzed using Method 8270 (SIM), all target analytes were non-detected at the reporting limits with the exception of di-n-butylphthalate and bis (2-ethylhexyl)phlalate, which were both detected above the reporting limit but less than either the DMMP SL or the Lowest Apparent Effects Threshold (LAET) dry weight criteria.

4.1.2 Sample Locations

Sample locations occupied during the March 2010 sampling of the interim sand cover were those prescribed in the QAPP which were crosschecked against post sand cover placement bathymetric survey results (Section 2).

Throughout sand cover sampling activities, a Trimble differential global positioning unit that used the U.S. Coast Guard differential correction was used. The DGPS was interfaced to an integrated navigation system that displayed the vessel position relative to target location and shoreline features in real time. Coordinates were recorded electronically and in the field log when the sampler reached the bottom.

4.1.3 Sand Cover Sediment Collections

All sand cover sediment samples were collected aboard the MSS's *MV Nancy Ann* using a 0.06 m^2 Gray-O'Hara boxcore. The use of the Gray-O'Hara boxcore represents a departure from the QAPP where a 0.3 m^2 hydraulically powered grab sampler was specified. The decision to use the Gray O'Hara boxcore was made due to the potential for deeper penetration in order to better define cap thickness (1.5 ft [45 cm] for the boxcore versus 1 ft [30 cm] for the power grab sampler) and the smaller areal sample size (0.06 m^2 versus 0.30 m^2 for the power grab). The smaller sample area allowed less of the cover to be disturbed or removed though sampling. At all stations sampled, the Gray-O'Hara was successful at penetrating through cap sediments to pre-cover strata, mostly at thicknesses that exceeded 30 cm (1 ft).

4.1.4 Sand Cover Sample Processing

All sand cover boxcore samples were processed and sample handled in accordance with the QAPP. The boxcore was brought to the surface, evaluated for sampling related disturbance and representativeness, and then measured for penetration and recovery. If sufficient sediment was collected in a good quality, undisturbed, representative sample, the overlying water was the siphoned, photographs of the sediment surface taken, logged, and then subsampling proceeded. Sample logs/descriptions are provided in the field logs (Appendix B).

Three samples representing the 0-10 cm, 10-20 cm and 20-30 cm depth intervals below mudline were acquired for each of the four sand-cover sampling stations and designated as the SG-xxA (Surface Grab – station numberA[0-10cm]), SG-xxB(10-20 cm) and SGx-xxC (20-30+cm). The sediment from each 10 cm strata was placed into pre-cleaned stainless steel bowls, homogenized and then placed into pre-cleaned, labeled sample jars, logged in the chain of custody form and kept on ice up to and through delivery to the analytical laboratory. Chain of custody forms are provided in Appendix E. Only the samples representing the top 10 cm of the sediment column were analyzed for chemical constituents. All other samples, representing the 10-20 cm and 20-30+ cm below mudline strata, were archived at -4 degrees C.

4.2 RESULTS

Sand cover sediments from the top 10 cm of the sediment column were submitted to Columbia Analytical Services for analyses; all other strata collected were archived. All sediment chemistry data underwent a Tier IV data validation by Pyron Environmental of Olympia, WA. The results from sediment chemical analyses of post-sand cover samples are provided in Appendix J.

As discussed, sand cover sediment samples were collected using a 0.06 m^2 Gray-O'Hara boxcore. In addition, two post-dredge sediment samples were taken by coring through the sand cover and then collecting the underlying native sediments. In each sample, a minimum thickness of clean sand cover could be determined and thicknesses are shown in Table 4-1 along with other station coordinates and water depths.

Table 4-1 Sand Cover Monitoring Stations and Sampling Data

Station	Date	Time	Latitude	Longitude	Sample Type	Drive Length	Sand Thickness	Notes
SG-01	3/10/2010	9:10	47 32.6403N	122 20.2812W	0.06 m^2 Boxcore	50 cm (1.64 ft)	>50 cm (1.64 ft)	
SG-02	3/10/2010	10:11	47 32.6534N	122 20.2870W	0.06 m^2 Boxcore	45 cm (1.48 ft)	45 cm (1.48 ft)	
SG-03	3/10/2010	11:06	47 32.6684N	122 20.3016W	0.06 m^2 Boxcore	36 cm (1.18 ft)	>36 cm (1.18 ft)	
SG-04	3/10/2010	14:34	47 32.6902N	122 20.3126W	0.06 m^2 Boxcore	27 cm (0.89 ft)	27 cm (0.89 ft)	
SC-03-2	3/10/2010	12:14	47 32.6697N	122 20.3019W	4" OD Vibracore	7 feet	23 cm (0.75 ft)	Clean contact between pre-cover and site sediment
SC-04-2	3/10/2010	13:59	47 32.6901N	122 20.3128W	4" OD Vibracore	7 feet	37 cm (1.21 ft)	Clean contact between pre-cover and site sediment
SC-04-3	3/10/2010	13:25	47 32.6900N	122 20.3118W	4" OD Vibracore	3.8 ft	10 cm (0.33 ft)	Sample disturbed, non-representative

For sand cover sediments, sediment chemistry results were compared to both DMMP and SMS criteria. The sand cover sediments were depauperate in both fine-grained sediment and total organic carbon. SMS criteria are based on normalization to TOC concentrations as a proxy for bioavailabilty. Given the very low TOC concentrations measured in sand cover surface sediments (<0.2%), the TOC normalizations in SMS comparisons, which are intended for sediments with TOC >0.5%, sand cover surface sediments were compared to LAET SMS criteria on a non-normalized, dry-weight basis. Comparisons to both the DMMP and LAET criteria are shown in Appendix J.

For both sand cover surface sediment samples collected after placement, there were no exceedances of DMMP or LAET chemical criteria for either detected analytes or the reporting limits of non-detected analytes. Although there were no exceedances of screening criteria, several LPAH, HPAH and dioxins were detected in sand cover sediments. The sands that were placed as the sand cover were analyzed prior to placement and no PAH compounds or dioxins were detected at concentrations greater than the reporting limit (Appendix I). The only SVOC compounds that were detected in the analysis of materials prior to its placement as the sand cover were the two phthalate esters, di-n-butylphthalate and bis-(2-ethylhexyl)phthalate.

During the field sampling, it was noted in the field log that occasional clasts of dark fine grained sediments that ranged from a few to 10+ cm in long axis dimension were present within the sand cover matrix. It is likely that these clasts were native/site sediments that were captured during sand cover placement. The contact between the underlying native/silt sediment and overlying sand cover was well defined, with little or no mixing. The fines that were observed as well as the detected analytes are likely a result of the clasts of fines sediments captured in the sand cover matrix. This sand cover samples that show the highest concentrations of PAH (though well under screening level criteria) are also the stations that show the greatest proportion of fine grained (silt or finer) sediments. There, although the clasts were noted, there appeared to be little or mixing between the xenoclasts and the cap sediments.

4.3 DATA QUALITY AND LABORATORY PERFORMANCE

Laboratory data for sand cover sediments underwent a Tier IV validation by Pyron Environmental. The full data validation report is provided in Appendix K. Although not specified in the Monitoring Plan, SVOCs were quantified, in addition to just LPAH and HPAH, as specified in the plan. All SVOC data is reported and validated.

All conventional parameters, Methods 8270 SVOCs and polychlorinated dioxins/furans by Method 1613B met quality control parameters set forth by the Monitoring plan with the following modifications:

- Data that was qualified due to laboratory or duplicate results that exceeded the criteria in the QAPP include:
  - Octochlorodibenzo-p-dioxin concentration for SG-02A was qualified as estimates (J) due to MS/MSD recovery RPDs outside of control limits.

  - Dimethyl phthalate concentrations for SG-01A, SG-02A, SG-51A were changed from estimated (J) values to non-detected values (U) due to detection of dimethyl phthalate in the method blank.
  - Octochlorodibenzo-p-dioxin concentrations for SG-01A, SG-02A,SG-03A, SG-04A and SG-51A were changed from estimated (J) values to non-detected values (U) due to detection in the method blank.
  - 1,2,3,4,6,7,8,-Heptachlorodibenzofuran concentrations for SG-01A, SG-02A, SG-04A and SG-51A were changed from estimated (J) values to non-detected values (U) due to detection in the method blank.

- Samples SG-01A and SG-051A were duplicate samples from the same homogenate. A comparison of results and tabulation of RPDs, or straight concentration difference where appropriate, is presented as an appendix in the data validation report (Appendix H). All RPDs and differences were within limits specified by the QAPP.

5. REFERENCES

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Appendix A

Bathymetric Survey Results

General Survey Notes:

Purpose:

This survey was made at the request of the Port of Seattle Engineering Department to support maintenance dredging operations at Terminal 115, Berth 1. This work was performed under Port of Seattle project 103773, T-115 Berth 1 Design.

The intent of this survey was to calculate payout volumes based upon pre- and post-dredge bathymetric surveys, conducted by the Port, of in situ materials at said location. Final Pay Volume was determined by creating a Digital Terrain Model (DTM) and generating AutoCAD Triangulated Irregular Network (TIN), of pre- and post-dredge hydrographic surveys and computing volumes to the nearest cubic yard.

Datums:

Horizontal Datum and Basis of Bearing:

North American Datum of 1983, Adjustment 2007, (NAD 83/07).
Washington State Plane Coordinate System (North Zone), as derived by GPS Observations.

Vertical Datum:

Mean Lower Low Water (MLLW)

Vertical Benchmarks:

Port of Seattle (POS): HAZ 1 Elevation = 19.34'
Contractor Benchmark: Elevation = 19.9'

Field Visitation:

Pre-dredge:

The field portion for the pre-dredge hydrographic survey was performed on December 01, 2009 (see Survey Data Table for times and tidal elevations).

Post-dredge:

The field portion for the post-dredge hydrographic survey was performed between the period of January 25, 2010 and February 25, 2010 (see Survey Data Table for times and tidal elevations).

Field Equipment:

- Ross Surveyor Model 960 Hydrographic Survey System
- Trimble DSM GPS Receiver
- Conventional hand lead lines (Manual Depth Measurement)

Bathymetry Survey Methods:
Daily discharge from the Duwamish River created strong water currents in the project area that impacted piloting and course travel. To mitigate these influences the pre- and post-dredge surveys were performed during periods of slack tide. Although not ideal, this was necessary to aid the helmsman in vessel navigation.

Prior to data collection vertical confirmation with POS benchmark HAZ 1 and contractor benchmarks were made, as well as adjustment to the project tide board. Transducer verification was also performed prior to and upon completion of activities. This was accomplished by implementing a bar check at the depths of 10 feet and 20 feet to confirm sonar draft below the water line.

Pre-dredge bathymetric data was collected by running lines parallel with the dock located at Berth 1 in the coverage area. Post-dredge bathymetric data was collected by running lines perpendicular to the dock.

Manual depth measurement techniques (conventional lead lines) were used in areas in which acoustic methods were not ideal. Derived elevations were noted accordingly.

Tide Elevations were noted in approximate intervals of 15 to 30-minutes. This was completed to document the accuracy of collected data and assist with post-processing efforts.

Horizontal positioning was determined by direct GPS observations resulting in real-time positional data.

Post-processing and Data Reduction:
Post-processing and data reduction was performed daily upon completion of field operations.

Post-processing software:
- HYPACK 2009, Hydrographic Survey Software
- Liscad v.8, Survey and Engineering Software

HYPACK 2009, Hydrographic Survey Software, was used to process the single-beam data collected. Tide elevations, times, and corrections were applied prior to editing data. Processed survey data was then reduced and defined to produce data in a 20-foot trackline interval. XYZ values were then exported for use in an American Standard Code for Information Interchange (ascii) file format.

The exported data was then brought into Liscad v.8, Survey and Engineering Software, in which a preliminary Digital Terrain Model (DTM) was created and checked for uniformity and quality. In addition, the DTM was compared to previous surveys for accuracy and consistency. Upon completion, the XYZ values were then exported in ascii file format and sent to the Port of Seattle Mapping Group

Final Volume Calculation and Data Exhibits:
Post-processed data was provided by field crew members in ascii file format. The Mapping Group, based upon the data received, calculated the final volumes, as well as prepared project exhibits and plots for this project.

Final Volume Calculation and Data Exhibit software:

- Autodesk Civil 3D Land Desktop Companion 2008

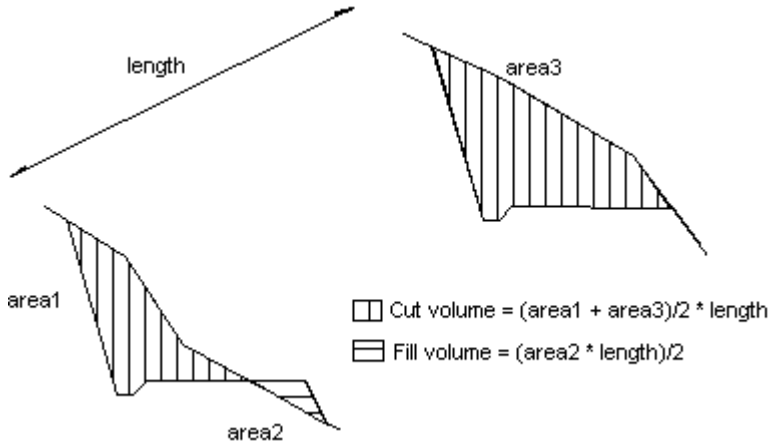
The XYZ ascii file was directly imported into AutoCad Civil 3D Land Desktop Companion 2008. Digital Terrain Models were then created using the provided data. Contours were generated using the Triangular Irregular Network (TIN) and were examined for quality and accuracy. Once verified, contours were overlaid for comparison and examined. A check was conducted to verify that the bathymetry data collected encompassed the project area.

Final Volume Calculations:

The values for the Final Volume Calculations were derived by the Average End Area Method . Computations, volume examination, and expressed results were performed using Autodesk Civil 3D Land Desktop Companion 2008

The Average End Area method calculates volumes by adding the area of a material type at one station to the area of the material type at the next station and dividing the sum by two, then multiplying the result by the distance between the sections (L=length).

$$V = \frac{L}{2}[A_1 + A_2]$$



Data Exhibits:

Plot files and pdfs illustrating the result of the survey were provided to the Port of Seattle Engineering Department for distribution.

SURVEY DATA TABLE:

Dates of Surveys	Data Description	Equipment Used	TIME (2010)	Tidal Elevation (TZ/EM/PF)
12/1/2009	Pre Dredge *by POS Survey*	Ross Surveyor Model 960	11:26	10.00
			11:54	10.50
			12:04	10.60
1/25/2010	Post Dredge as of 1/25/2010	Ross Surveyor Model 960	9:13	11.40
			9:32	11.50
1/27/2010	Post Dredge as of 1/27/2010	Ross Surveyor Model 960	8:40	9.50
			9:52	9.80
2/5/2010	Post Dredge as of 02/5/2010	Ross Surveyor Model 960	9:17	13.30
			10:01	12.70
2/8/2010	To fill-in open area not covered from 2/5/2010	Ross Surveyor Model 960	9:06	9.60
			9:23	9.70
2/10/2010	Additional Lead Line Points	Ross Surveyor Model 960	9:17	8.40
			9:39	8.40
2/16/2010	Post Dredge as of 02/16/2010	Ross Surveyor Model 960	8:51	10.30
			8:57	9.90
			9:26	9.00
			9:33	8.70
2/17/2010	Post Dredge as of 02/17/2010 Additional Lead Line Points	Ross Surveyor Model 960	8:31	10.70
			9:40	8.80
			2:28	15.90
			3:30	14.30
2/19/2010	Additional Lead Line Points Post Dredge as of 2/19/2010 *FINAL (2/17 & 2/19 combined)*	Ross Surveyor Model 960	9:06	10.80
			9:31	10.20
			10:08	9.20
2/23/2010	Sand Cap Topo as of 2/23/2010	Ross Surveyor Model 960	10:09	10.50
			10:31	10.60
			10:45	10.50
			11:06	10.40
			11:53	10.00

2/25/2010	Sand Cap Topo as of 2/25/2010 *FINAL*	Ross Surveyor Model 960	8:46	8.30
			9:23	8.50
			9:28	8.50
			9:36	8.70
			9:48	8.80

Appendix B

Field Logs

7/27/10

Sediment Sampling
Jewett
Thompson Bromley

Onsite 0946

TTIS-SC-01 Drive 1 @ 1000/hrs.
LAT 47 32.6386
LON 122 20.2852
Time 1000 – 1005 drive time
P 6' (71 3/4")
R 2'9"
Depth 28.2' Rejected

Compact clay/sandy till in catcher
Compact sandy gravel,
Insufficient recovery. Reject & drive again

TTIS-SC-01-C2 Drive 2 1030
Lat 47 32.6904 Lon 122 20.2812
Time 1030 – 1035 Depth 29.2
Penetration 7' Recovery 5'

Easy aquisition: Free fall to 3' and then to 4.7'
Black silt in bottom of core catcher

SC-02 Drive 1

Lat Lon
Time 1100 Depth 27.7
Penetration Recovery

Tide Gage 10.6 @ 1100
Note: A pressure tide gage has been installed

Reject: Core fell over & some material
Moved & reset

SC-02-C1 Drive 2
Lat 47 32.6536 Lon 122 20.2867
Time 1111 – 1111.5 Depth 27.9
Penetration 7' Recovery 5'8"

Had to push out further as construction crew had vessel in the area.
Easy & Quick, full penetration
Fine black silt

SC-03 Drive 1

Lat 47 32.6698 Lon 122 20.2972
Time 1137 Depth 27.7
P 5' R 3.3'

Station ~ 27' East of designated point
Hit rejection at 4.8'
Tide gage ~~10.~~ 11.0 at 1141

Clay w/ heavy gravel in shoe.

Recovery insufficient. Rejected.

SC-03-02 Drive 2

Lat 47 32.6708 Lon 122 20.2946
Time 1201 Depth 27.5
P ~4' R 0

Station ~ 34' of plan point
Sample rejected for insufficient penetration.

SC-03-03 Drive 3

Lat 4732 6752 Lon 122 20.2993
Time 1214 - 1218 Depth 28.2'
P @ ~~28.2~~ 7' R 4' 11"

Nothing Fine gravel in core catcher

SC-04-01 Drive 1

Lat 47 32.6858 Lon 122 20.3011
Time 12:53 Depth 29.7
P 60" R 2'
Refusal at 5'
Rejected

Note: At the coordinates given in the work plan, we were outside the dredge footprint at ~ 150 ft. from Dock C. Figure 3 in the Work Plan showed that Station 4 was only 100 ft from station 3 / midpoint of Pier C.
Executive decision to move station #8 within 100 ft. of Dock C to ensure being w/in the dredge footprint.

SC04-02 Drive 2

LAT 47 32 6850 LON 122 20 3052
Time 1324 Depth 29.0
P 5'10" R 3'8"

Silty gravel in cutter. Silt/coarse sand in cutter
Rejected

10'4" Tide Gag at 1345

SC04-03 Drive 3 1347
LAT 47 32.6831 LON 122.20293
Time 1344-1359. Depth 30.8
P 7 R

Rejected core as the sample location was outside the dredge footprint (450') in Figure 3 of the QAPP.

SC04-04 Drive 4
LAT 47 32.6826 LON 122 20.3090
Time 1402 Depth 29.6
P R
Core fell over - rejected

SC04-05 Drive 5
LAT 47 32 6821 LON 122 20 3084
Time 1414 Depth 28.8
P 3.5 R
Rejected

SC04-06 Drive 6
LAT 47 32 6797 LON 122 20 3074
Time 1432 Depth 28.8
P 4½' R 0
Tipped Over Rejected

After 5 failed cores spoke w/ Jan Shaw. He suggested we collect back @ SC04-03 and get a sample, even if it is outside the dredge prism.

SC04-07 Drive 7
LAT 47 32 6833 LON 122 20 2982
Time 1447 Depth 30.8
P = 7 R = 4.8"

Fine sand in shoe.

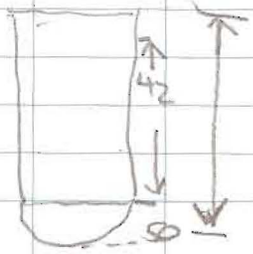
3/10/2018

0800 Onboard
Bill Jaworski
Dale
Dae
Tim

Safety
→ Grey O'ttra heavy. Any swell will tip that over.
→ Hands slip, trip, fall.

Station SG-01
~~0908~~ 0910 47 32.6403/122 20.2812
Grey O'ttre P=50 cm
Depth 23.7 R=42 cm

Depth to sample in yards is 50 cm



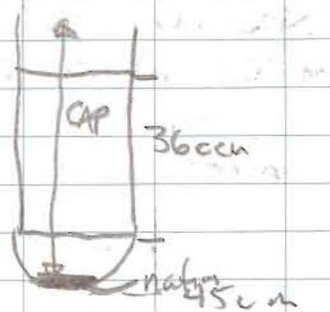
The entire sample is composed of coarse sand w/ 4-8cm graded intervals.

10YR 4/2 soft wet coarse sand w/ graded sequences. Trace < 1% silt. 1mm band of silt @ SWI with several burrowlets that collapsed when water was siphoned off. No odor. No sheen.

Tide Gage 1009 8ft.

Station SG-02
1011
Grey O'tre P=44
Depth=23.6 R=36
47 32.6534 10:11
122 20.2870

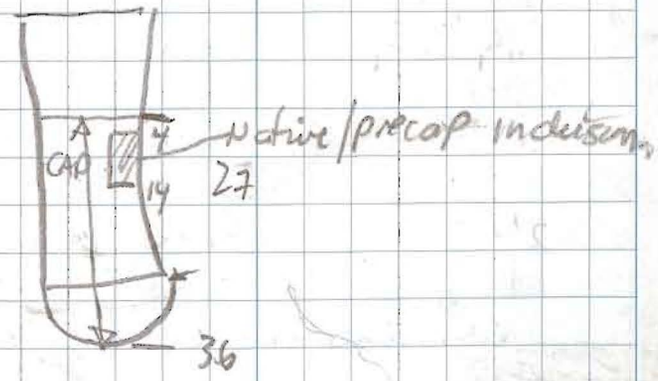
10YR 3/2 Soft, wet, loose, poorly sorted normally graded coarse sand w/ trace silt (<1%). Surface has 1mm veneer of silt/very fine sand. ~~Penetration~~ to bottom of jaws is 4.5cm and 0.5cm of black, soft, wet silt @ bottom of sampler and represents pre-cap material



SG-03 47 32.6684 122 20.301b
D=24.1 P= 3 to cm to jaws
1106 R= 27cm to box

Sheen in overlying water. Dull blue.

10YR 4/2 Surface, loose, wet, poorly sorted normally graded coarse sand w/ trace silt (<1%). Thin <1mm veneer of fines. Several normally graded 4-15cm sequences 10 x 10 x 15 inclusion of native material (pred ridge black silt/clay w/sheen). Large clast of pre-cap sediment was present in 4-14cm depth interval and covered ≈ 20% of boxcore surface area. The inclusion contributed to both the 0-10 & 10-20cm interval sample volumes.



SC-03

Drive 8ft tube → 7' of penetration if successful.

1214 47 32.6697 / 122 20.3019
D = 24.6 P = 7
R = 4'7"

Cap sand in catcher

1st cut @ surface cap sand 10YR 4/2 coarse sand w/ fine veneer. No odor. No sheen in overlying water.

cut @ 2' below mudline. black, soft, slightly consolidated silty clay w/ slight H_2S odor. consistent w/ material observed in pre-cap cores.

2'-4.5" Section 3B at 4.5' cut, ~~coarse~~ fine rounded gravel w/ trace coarse sand. Different than cap material gravels are lithic. No odor, No sheen.

Lunch 1245 - 1315

47 32.6900 13:25
122 20.3118

SC-04
D = 25.2 P = 3.8
1327 R = 3.7

Tide Gage 1330 8.8

Elected to try a second core.

SC-04-2 47 32.6901
D = 23.8 122 20.3128
P = 7'
R = 4.9'
T = 1359
Sand in core catcher

Good recovery. Sand/Gravel in catcher

SG-04- (@SC-04-2) 47 32.6902
D = 24.1 122 20.3126
P 27
R
T = 1434

Back at dock 1503

3/11 0906

Processing: T. Thompson + Dave Browning.

SC-03 Process
See log notes
Sufficient material to take duplicate

SC032 ZA 100310 1214
SC532 ZA " " Field Dup
ZB
ZC
ZD

SC532 Only sufficient material for 1-16 + 1-8 oz jar

SC042
Took 4 layers
SC042 ZA MS/MSD

ZD 1-16oz + 4-8oz.

SC-0421 Had rejected this sample. However, sufficiently different (clay vs. sand) to cascade sample into remaining jars.

Appendix C

Core Logs

Sediment Core Processing Log

Job: T115 Post Dredge Charact
Core Location/Sample Number: T115 SC-01
Job Number:
Date/ Time: 1/28/10
No. of Sections: 2
Sample Logged by: D. Browning
Sample Length (from log):
Type/Diameter of Sample: 4" Vibracore
Avg. % Compaction:
Sample Quality: (good) fair poor disturbed
Notes:

Recovered Length (ft)	% Compaction	Color	Size % - G	Size % - S	Size % - F	PID	Description (grain size, color, moisture, sheen/odor, biota, wood, other debris)	Insitu Actual Depth (ft)	Sample Depth	Subsample No.	Summary Sketch
						Entire Core GLEY 2.5/1 Blue	0-74cm, Soft, wet, blue slightly coarse sandy (5) clayey (40-50) silt (45-55). Slight H_2S odor. Sand evenly dispersed. In-situ 2-3 mm blebs of sheens at 39-42cm. 1x3 cm smear of buff clay @ 45 cm & 56 cm. Scattered twigs (0.3 x 2-3cm)		0-1 ZA 1-2 ZB		
							72-101. Slightly soft, damp, silty (30-40) CLAY (60-70) Rock @ 84cm 1x2.5cm slight tar/asphalt odor produces dull blue sheen w/ H_2O_2.		2-3 ZC		
							101-105 mixed silt clay (above) and coarse, angular sand (whole units 30% fines 70% sand). Soft. Damp. Slight tar & H_2S odors. cannot produce sheen w/ H_2O_2. Variate grain size range to fine gravel. Mineral/lithic. and appears construction related		3-4 ZD		
							105-108 cm slightly soft damp silty clay (30/70) plastic mica (1%) coarse sand. produces mini dull sheen. Slight sulfide odor.		4-5 ZE		
							108-112. silty (10) clayey (10%) coarse sand (50) & gravel. (30). Firm, moist.				
							112-120 same as 105-108				
							120-126 same as 108-112				
							126-139 produces dull blue sheen.				

f:/fieldforms/coreprocess

Sediment Core Processing Log

Job: Port of Seattle T115 POST-DREDG | Core Location/Sample Number: T115-SC-02

Job Number: | Date/ Time: 1/28/10 11:40

No. of Sections: 2 (1+ catcher) | Sample Logged by: D. Browning

Sample Length (from log): | Type/Diameter of Sample: 4" Vibrcore

Avg. % Compaction: | Sample Quality: good fair poor disturbed

Notes:

Recovered Length (ft)	% Compaction	Color	Size % - G	Size % - S	Size % - F	PID	Description (grain size, color, moisture, sheen/odor, biota, wood, other debris)	Insitu Actual Depth (ft)	Sample Depth	Subsample No.	Summary Sketch
						GLEY 2.5/1	0-78 loose, soft, wet trace sandy (<5%) clayey (30-40) silt (60-45). Small scattered twig fragments/ leaf fragments. Moderate H_2S odor. 1cm blob of in-situ silty sheen @ 36cm.		0-1 ft ZA		
							78-101 10Y 5/1 very soft wet clay, homogenous in texture. 2cm clot of black silty clay @ 94-96 cm.		1-2 ft ZB		
							101-104 GLEY 5/1, silty, wood fragments, Wood is laminarly oriented & fragmented. Minor Sand admixed.		2-3 ft ZC		
							104-153 slightly soft, damp, trace fine sandy, silty (30-40) clay (60-70) plastic. Organic ≥ 190. H_2S and slight oily/tar odor. Heterogeneous in density		3-4 ft ZD		
							material in catcher 5-6' was similar to 104-153				

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Sediment Core Processing Log

Job: Port of Seattle T115 Post Dredge
Core Location/Sample Number: T115 SC-03
Job Number:
Date/ Time: 1/28/10 14:15
No. of Sections: 1 + shoe/catcher
Sample Logged by: D. Browning
Sample Length (from log):
Type/Diameter of Sample: 4" Vibracore.
Avg. % Compaction: 4' r 11" (Catcher)
Sample Quality: good fair poor disturbed
Notes:

Recovered Length (ft)	% Compaction	Color	Size % - G	Size % - S	Size % - F	PID	Description (grain size, color, moisture, sheen/odor, biota, wood, other debris)	Insitu Actual Depth (ft)	Sample Depth	Subsample No.	Summary Sketch
							0-36cm loose, very soft, wet Gley 2.5/1, trace medium Sandy (3-5%) very clayey (40) silt (55-60). H_2S odor. highly reduced. scattered organic particles. 1cm diameter pea gravel particle @ 29cm.		0-1 ft ZA		
							36-53cm 5Y 4/1, soft, cohesive, moist clay.		1-2 ft ZB		
							36-39cm above is interfingered w/ thin 1-2mm bands of black sediment. Slight organic odor.		2-3 ft ZC		
							53-69cm GLEY 2.5/1 black, highly reduced, soft wet silty (40) clay (60) trace sand. H_2S odor. Sheen w/ application of H_2O dull blue.		3-4 ZD		
							69-89cm GLAY 2.5/1 80-99 1 large cobble. Normally graded, poorly sorted. Reduced. Firm, moist.		ZE		
							89-102 GLey1 3/1, Soft damp, medium sand that is reversely graded. Slight organic (natural & tar odor)				
							102-114. Gley 2.5/1. black, soft, damp, silty (20-30) clay (70-80). Plastic. H_2S odor, slight tar odor. No in situ sheen.				
							114-122 GLey1 3/1. soft damp gravelly (20-30) medium Sand (70) No odor, No sheen.				
							122-4'11" Gravelly sand.				

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Sediment Core Processing Log

Job: PORT OF SEATTLE T115 POST DREDGE | Core Location/Sample Number: SC-04

Job Number: | Date/ Time: 1/28/10 16:00

No. of Sections: 1 | Sample Logged by: D Brawner

Sample Length (from log): 4' 8" | Type/Diameter of Sample: 4" Ubracil

Avg. % Compaction: | Sample Quality: (good) fair poor disturbed

Notes:

Recovered Length (ft)	% Compaction	Color	Size % - G	Size % - S	Size % - F	PID	Description (grain size, color, moisture, sheen/odor, biota, wood, other debris)	Insitu Actual Depth (ft)	Sample Depth	Subsample No.	Summary Sketch
							0-98 cm, Unconsolidated to soft, wet, trace sand (1-2%) silty (40-50) clay (50-60). Scattered plant fragments in upper 45 cm. Preserved methane vesicles. 1-2 mm sand stringer @ 20 cm. 98-98 unsorted blocky heterogeneous texture w/ cohesive clasts of silty clay in wetter matrix (80 clasts, 20 matrix). Becomes plastic w/ depth (entire unit).		0-1 ft SC04 ZA		
									1-2ft SC04 ZB		
									2-3 ft ZC		
									3-4ft ZD		
							98-122 Gley 1 3/1 damp firm, gravelly (30) coarse sand (70). Ungraded poorly sorted, little to no fines				

f:/fieldforms/coreprocess

Sediment Core Processing Log

Job: T115 Port of Seattle POST-CAP

Job Number:

No. of Sections: 2

Sample Length (from log): 5'6-6" of caldera

Avg. % Compaction: full drive (7 ft) 50 4.5

Notes:

Core Location/Sample Number: SC-032

Date/ Time: 3/11/10 process 09:15

Sample Logged by: D. Browning

Type/Diameter of Sample: 4" Vibracore

Sample Quality: **good** fair poor disturbed

Recovered Length (ft)	% Compaction	Color	Size % - G	Size % - S	Size % - F	PID	Description (grain size, color, moisture, sheen/odor, biota, wood, other debris)	Insitu Actual Depth (ft)	Sample Depth	Subsample No.	Summary Sketch
							0-23 cm, loose, wet, (>99%) graded (normally) coarse sand. Cap Material Sands are glacial and subrounded lithic. No odor, No sheen. 5Y 4/3 2-3 mm bands of black silt interstitial to sand @ 18 & 21 cm and are trapped resuspended native material that was stirred up in placement		0-23 cm cap; 2A		
							22-76 2.5Y 3/2 black soft, wet, almost plastic, slightly dilatent very (40/60) clayey silt. Collapses @ 1/4" ribbon. Slight H_2S odor. Produces sheen w/ application of water.		2B; 2C		
							76-83 cm Gley1 5/1, soft moist angular medium sand. Trace gravel (<5%)				
							83-89. Firm, damp, cohesive clayey silt (40/60) 7YR 3/1. Slight charcoal/burnt odor. produces dull sheen w/H2O.		2D		
							89-140 2.5Y 5/3. Loose, moist to damp, gravelly (20-30) coarse sand (70%) Normally graded. Sands are subrounded to rounded. Sands & gravels are lithic				

Sediment Core Processing Log

Job: T115 Port of Seattle Post-Cap

Core Location/Sample Number: SC-04 2

Job Number:

Date/ Time: Collect 3/10/10 14:06 process 3/11/10 10:30

No. of Sections: 1

Sample Logged by: D Browning

Sample Length (from log): 5'

Type/Diameter of Sample:

Avg. % Compaction:

Sample Quality: good fair poor disturbed

Notes:

Recovered Length (ft)	% Compaction	Color	Size % - G	Size % - S	Size % - F	PID	Description (grain size, color, moisture, sheen/odor, biota, wood, other debris)	Insitu Actual Depth (ft)	Sample Depth	Subsample No.	Summary Sketch
							0-37cm Cap Sand Coarse sand, loose, wet Soft. Rounded, glacial Angled contact from 31-37cm. 3mm band of black interstitial silt @ 36.5cm (angled. 37-145, 2.5Y 5/2 Dense, firm, unsorted. coarse sandy (30) gravel (70), Ungraded. gravels are rounded and lithic ranging in size from 2-10cm No odor No sheen.		0-37 cm CAP ZA ZB ZC ZD		

f:/fieldforms/coreprocess

Sediment Core Processing Log

Job: Port of Seattle

Core Location/Sample Number: SC-04-3 Reject.

Job Number:

Date/ Time: 3/10/10 collect 3/11/10 proces

No. of Sections:

Sample Logged by: D. Browning

Sample Length (from log):

Type/Diameter of Sample:

Avg. % Compaction:

Sample Quality: good fair poor disturbed

Notes:

Recovered Length (ft)	% Compaction	Color	Size % - G	Size % - S	Size % - F	PID	Description (grain size, color, moisture, sheen/odor, biota, wood, other debris)	Insitu Actual Depth (ft)	Sample Depth	Subsample No.	Summary Sketch
							0-10 cap		10cm CAP		
							10-35, loose, 10YR 4/3 unconsolidated brown wet, clayey 30 silt (60) with minor coarse sand (10)		ZA	*	
							36-46 - ungraded poorly sorted fine silty (10) coarse sand (90)				
							46-78 same as 10-35 10YR 4/2				
							* Kept based on conversation w/ Port of Seattle				

f:/fieldforms/coreprocess

Appendix D

Sediment Core Photographs

(Note: This appendix is provided on DVD)

Appendix E

Chain of Custody

Columbia Analytical Services, Inc.
An Employee - Owned Company

CHAIN OF CUSTODY

Sediment and Tissue Chemistry

1317 South 13th Ave. • Kelso, WA 98626 • (360) 577-7222 • FAX (360) 636-1068

SR#: _____

PAGE 1 OF 1 COC # _____

PROJECT NAME: Port of Seattle T115 Post Dredge
PROJECT NUMBER:
PROJECT MANAGER: Tim Thompson / Mindy Lin
COMPANY/ADDRESS: 4401 LATONA AVE NE SEATTLE WA 98105
EMAIL: TThompson@SEELLC.com
PHONE #: 206-419-6173
FAX #: 206-418-6187
SAMPLER'S SIGNATURE:

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	☐ Total Volatile Solids ☒ Total Solids	TOC ☐ (ASTM D4129M) ☒ PSEP	Grain size ☒ PSEP ☐ ASTM D422	Sulfide ☐ Total (9030M) ☐ PSEP ☐ Water Soluble	☐ AVS ☐ SEM (metals list below)	Ammonia ☐ Total (350.1m) ☐ Plumb ☐ Pore water	Metals (list below)	Pesticides (8081-L)	PCBs (8082-L) ☒ Aroclors ☐ Congeners	Semivolatiles ☒ PAH GC/MS SIM ☐ 8270-L	Organotins ☐ Bulk ☐ Pore Water ☐ TBT only	Volatiles (8260)	Dioxins ☒ 1613 ☐ 8290	☐ NWTPH ☐ 8015 ☐ GRO ☐ DRO ☐ RRO	☐ Lipids	Tissue Sample Preparation (Instructions below)	ARCHIVE ONLY			REMARKS
T115-SC-01-100127 2A	1/27/10	09:44		SED	4	X	X	X						X	X			X							SC-01-2A
T115-SC-01-100127 2B					4	X	X	X						X	X			X							SC-01-2B
T115 SC01 100127 2C					4	X	X	X						X	X			X							SC-01-2C
T115 SC01 100127-2D					4	X	X	X						X	X			X							SC-01-2D
T115 SC01 100127 2E	↓	→		↓	4			X														X			SC-01-2E

REPORT REQUIREMENTS

___ I. Routine Report: Method Blank, Surrogate, as required
___ II. Report Dup., MS, MSD as required
X III. Data Validation Report (includes all raw data)
___ IV. CLP Deliverable Report
___ V. EDD

INVOICE INFORMATION

P.O. # _____
Bill To: _____

TURNAROUND REQUIREMENTS

___ 24 hr. ___ 48 hr.
___ 5 Day
X Standard (15 working days)
___ Provide FAX Results

Requested Report Date

Circle which metals are to be analyzed:

SMS Metals: As Cd Cr Cu Pb Hg Ag Zn
CA Metals: Ag As Cd Cr Cu Hg Ni Pb Se Zn
SEM Metals: Cd Cu Pb Hg Ni Zn

SPECIAL INSTRUCTIONS/COMMENTS:

archive remaining material
For SVOCs, SIM on ~~8270~~ PAH only, remaining SVOC: 8270
* Refer to T115 Post-Dredge Subsurface Sediment Char. QAPP

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature: [signature]	Signature:	Signature:	Signature:
Date/Time: 1/29/10 17:36	Date/Time: 1/29/10 1630	Date/Time:	Date/Time:
Printed Name: DAVID BLANDIN	Printed Name:	Printed Name:	Printed Name:
Firm: SEA	Firm: SEA	Firm:	Firm:

COCSTC 7-04

Columbia Analytical Services, Inc.
An Employee - Owned Company

CHAIN OF CUSTODY

Sediment and Tissue Chemistry

1317 South 13th Ave. • Kelso, WA 98626 • (360) 577-7222 • FAX (360) 636-1068

SR#: _____

PAGE 1 OF 1 COC # _____

PROJECT NAME: Port of Seattle T115 Post Dredge

PROJECT NUMBER:

PROJECT MANAGER: Tim Thompson / Mindy Lin

COMPANY/ADDRESS: 4401 Latona Ave NE Seattle WA 98105

EMAIL: tthompson@seattle.com

PHONE # 206-618-6173

FAX # 206-618-6187

SAMPLER'S SIGNATURE:

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	☐ Total Volatile Solids ☒ Total Solids	TOC ☐ (ASTM D4129M) ☒ PSEP	Grain size ☒ PSEP ☐ ASTM D422	Sulfide ☐ Total (9030M) ☐ AVS	☐ PSEP ☐ Water Soluble ☐ SEM (metals list below)	Ammonia ☐ Total (350.1m)	☐ Plumb ☐ Pore water Metals (list below)	Pesticides (8081-L)	PCBs (8082-L) ☒ Aroclors ☐ Congeners	Semivolatiles ☒ PAH GC/MS SIM ☐ 8270-L	Organotins ☐ Bulk ☐ Pore Water ☐ TBT only Volatiles (8260)	Dioxins ☐ 1613 ☐ 8290	☐ NWTPH ☐ 8015 ☐ GRO ☐ DRO ☐ RRO	☐ Lipids	Tissue Sample Preparation (Instructions below)	ARCHIVE ONLY			REMARKS
T115-SC02-100127-2A	1/27/10	11:11		SED	4	X	X	X						X	X			X						SC-02-2A
" -2B					4	X	X	X						X	X			X						SC-02-2B
" -2C					4	X	X	X						X	X			X						SC-02-2C
" -2D					4	X	X	X						X	X			X						SC-02-2D
" -2E					4																X			SC-02-2E
T115-SC02-100127-2F					4																X			SC-02-2F

REPORT REQUIREMENTS

___ I. Routine Report: Method Blank, Surrogate, as required

___ II. Report Dup., MS, MSD as required

X III. Data Validation Report (includes all raw data)

___ IV. CLP Deliverable Report

___ V. EDD

INVOICE INFORMATION

P.O. # _____

Bill To: _____

TURNAROUND REQUIREMENTS

____ 24 hr. ____ 48 hr.

____ 5 Day

X Standard (15 working days)

____ Provide FAX Results

_____ Requested Report Date

Circle which metals are to be analyzed:

SMS Metals: As Cd Cr Cu Pb Hg Ag Zn

CA Metals: Ag As Cd Cr Cu Hg Ni Pb Se Zn

SEM Metals: Cd Cu Pb Hg Ni Zn

SPECIAL INSTRUCTIONS/COMMENTS:

archive remaining material

For SVOCs, SIM in PAH only, remaining SVOCs 8270C

*Refer to: T115 Post Dredge subsurface Sed. Char QAPP

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature: [signature]	Signature:	Signature:	Signature:
Date/Time: 1/29/10 12:30	Date/Time:	Date/Time:	Date/Time:
Printed Name: DAVID BROWN	Printed Name:	Printed Name:	Printed Name:
Firm: CAS	Firm: CAS	Firm:	Firm:

COCSTC 7-04

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SR#: _____

PAGE 1 OF 1 COC # _____

PROJECT NAME: Port of Seattle T115 Post Dredge
PROJECT NUMBER:
PROJECT MANAGER: Tim Thompson / Mingfu Lin
COMPANY/ADDRESS: 4401 Leary Ave NE Seattle WA 98105
EMAIL: tthompson@seelle.com
PHONE #: 206-418-6173
FAX #: 206-418-6199
SAMPLER'S SIGNATURE: David C. Dr

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	☐ Total Volatile Solids ☒ Total Solids	TOC ☐ (ASTM D4129M) ☒ PSEP	Grain size ☒ PSEP ☐ ASTM D422	Sulfide ☐ Total (9030M) ☐ AVS ☐ SEM (metals list below)	Ammonia ☐ Total (350.1m)	Metals (list below) ☐ Plumb ☐ Pore water	Pesticides (8081-L)	PCBs (8082-L) ☒ Aroclors ☐ Congeners	Semivolatiles ☒ PAH GC/MS SIM ☐ 8270-L	Organotins ☐ Bulk ☐ Pore Water ☐ TBT only	Volatiles (8260)	Dioxins ☒ 1613 ☐ 8290	☐ NWTPH ☐ 8015 ☐ GRO ☐ DRO ☐ RRO	☐ Lipids	Tissue Sample Preparation (Instructions below)	ARCHIVE ONLY			REMARKS
T115 SC03 100129 2A	1/27/10	12:18		SED	4	X	X	X					X	X			X							
" -2B					5	X	X	X					X	X			X							
" -2C					4	X	X	X					X	X			X							
" -2D					4	X	X	X					X	X			X							
" -2E					4																X			

REPORT REQUIREMENTS

___ I. Routine Report: Method Blank, Surrogate, as required
___ II. Report Dup., MS, MSD as required
X III. Data Validation Report (includes all raw data)
___ IV. CLP Deliverable Report
___ V. EDD

INVOICE INFORMATION

P.O. # _____
Bill To: _____

TURNAROUND REQUIREMENTS

____ 24 hr. ____ 48 hr.
____ 5 Day
X Standard (15 working days)
____ Provide FAX Results

_____
Requested Report Date

Circle which metals are to be analyzed:

SMS Metals: As Cd Cr Cu Pb Hg Ag Zn
CA Metals: Ag As Cd Cr Cu Hg Ni Pb Se Zn
SEM Metals: Cd Cu Pb Hg Ni Zn

SPECIAL INSTRUCTIONS/COMMENTS:

archive remaining materials
For SVOCs SIM for PAH only remaining SVOCs 8270C
* Refer to: T115 Post Dredge Subsurface Sed. Char QAPP
* Duplicate Samples for SC-03-2B SVOC/PCB & Dioxi/Furans.

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature: [signature]	Signature: [signature]	Signature:	Signature:
Date/Time: 1/29/10 12:30	Date/Time: 1/29/10 1730	Date/Time:	Date/Time:
Printed Name: David Prowitt	Printed Name: [illegible]	Printed Name:	Printed Name:
Firm: SLR	Firm: CAS	Firm:	Firm:

COCSTC 7-04

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Sediment and Tissue Chemistry

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SR#: ____

PAGE 1 OF 1 COC #: ____

PROJECT NAME: Port of Seattle T115 Post Dredge

PROJECT NUMBER: Tim Thompson / Minsta Cin

PROJECT MANAGER:

COMPANY/ADDRESS: 4401 Latona Ave NE Seattle WA 98105

EMAIL: ttiumpson@seellc.com

PHONE #: 206-418-6173

FAX #: 206-418-6187

SAMPLER'S SIGNATURE: [signature]

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	☐ Total Volatile Solids	TOC (9060) ☒ Total Solids	Grain size ☒ PSEP ☐ (ASTM D4129M) ☒ PSEP	Sulfide ☐ Total (9030M) ☐ ASTM D422	☐ AVS ☐ PSEP ☐ Water Soluble	Ammonia ☐ Total (350.1m) ☐ SEM (metals list below)	Metals (list below) ☐ Plumb ☐ Pore water	Pesticides (8081-L)	PCBs ☒ Aroclors (8082-L) ☐ Congeners	Semivolatiles ☒ PAH GC/MS SIM ☐ 8270-L	Organotins ☐ Bulk ☐ Pore Water ☐ TBT only	Volatiles (8260)	Dioxins ☒ 1613 ☐ 8290	☐ NWTPH ☐ 8015 ☐ GRO ☐ DRO ☐ RRO	☐ Lipids	Tissue Sample Preparation (Instructions below)	ARCHIVE ONLY			REMARKS
T115SC041001272A	1/27/10	14:47		SED	4	X	X	X						X	X			X							SC-04-ZA
" -ZB	"	"		"	5	X	X	X						X	X			X							SC-04-ZB
" -ZC	"	"		"	4	X	X	X						X	X			X							SC-04-ZC
" -ZD	"	"		"	4	X	X	X						X	X			X							SC-04-ZD
" -ZE	"	"		"	2																	X			SC-04-ZE

REPORT REQUIREMENTS

___ I. Routine Report: Method Blank, Surrogate, as required

___ II. Report Dup., MS, MSD as required

X III. Data Validation Report (includes all raw data)

___ IV. CLP Deliverable Report

___ V. EDD

INVOICE INFORMATION

P.O. # ____

Bill To: ____

TURNAROUND REQUIREMENTS

___ 24 hr. ___ 48 hr.

___ 5 Day

X Standard (15 working days)

___ Provide FAX Results

____ Requested Report Date

Circle which metals are to be analyzed:

SMS Metals: As Cd Cr Cu Pb Hg Ag Zn

CA Metals: Ag As Cd Cr Cu Hg Ni Pb Se Zn

SEM Metals: Cd Cu Pb Hg Ni Zn

SPECIAL INSTRUCTIONS/COMMENTS:

x ARCHIVE RESIDUAL materials

x For SVOCS SIM for PAH only remaining SVOCS 8270C

* Refer to: T115 Post Dredge Subsurf Sed Char. QAPP

JARS: ZA, ~~ZB~~, ZC, ZD 2-16 oz + 2 8oz

ZE -

ZB - 3 16oz + 2 8oz (MS/MSD)

RELINQUISHED BY:		RECEIVED BY:		RELINQUISHED BY:		RECEIVED BY:	
[signature]	1/29/10 1730	[signature]	1/29/10 1730				
Signature	Date/Time	Signature	Date/Time	Signature	Date/Time	Signature	Date/Time
David Browning	SEE	[illegible]	CAS				
Printed Name	Firm	Printed Name	Firm	Printed Name	Firm	Printed Name	Firm

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Sediment and Tissue Chemistry

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SR#: ______

PAGE 1 OF 1 COC # ______

PROJECT NAME: Port of Seattle T115 POST-DREDGE
PROJECT NUMBER:
PROJECT MANAGER: Tim Thompson
COMPANY/ADDRESS: 4401 LATONA AVE NE SEATTLE WA 98105
EMAIL:
PHONE #: 206-418-6173
FAX #: 206-418-6187
SAMPLER'S SIGNATURE: [signature]

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	☐ Total Volatile Solids ☒ Total Solids	TOC ☐ (ASTM D4129M) ☐ PSEP	Grain size ☒ PSEP ☐ ASTM D422	Sulfide ☐ Total (9030M) ☐ PSEP ☐ Water Soluble	☐ AVS ☐ SEM (metals list below)	Ammonia ☐ Total (350.1m) ☐ Plumb ☐ Pore water	Metals (list below)	Pesticides (8081-L)	PCBs ☒ Aroclors (8082-L) ☐ Congeners	Semivolatiles ☒ PAH GC/MS SIM ☐ 8270-L	Organotins ☐ Bulk ☐ Pore Water ☐ TBT only	Volatiles (8260)	Dioxins ☒ 1613 ☐ 8290	NWTPH ☐ GRO ☐ DRO ☐ RRO ☐ 8015	☐ Lipids	Tissue Sample Preparation (Instructions below)	ARCHIVE			REMARKS
T115 SC032 100310 ZA	3/10/10	12:14		SCD	4	X	X	X						X	X			X				X			
T115 SC032 100310 ZB	↓	12:14		↓	4	X	X	X						X	X			X				X			
T115 SC032 100310 ZC	↓	12:14		↓	4	X	X	X						X	X			X				X			
T115 SC032 100310 ZD	↓	12:14		↓	4	X	X	X						X	X			X				X			
T115 SC053 2100310 ZA	↓	12:14		[illegible]	4	X	X	X						X	X			X				X			
T115 SC042 100310 ZA	↓	14:34		↓	5	X	X	X						X	X			X				X			MS/MSD
T115 SC042 100310 ZB	↓	14:34		↓	4	X	X	X						X	X			X				X			
T115 SC042 100310 ZC	↓	14:34		↓	4	X	X	X						X	X			X				X			
T115 SC042 100310 ZD	↓	14:34		↓	5	X	X	X						X	X			X				X			
T115 SC043 100310 ZA	↓	13:20		↓	4	X	X	X						X	X			X				X			1 liter 4-oz

REPORT REQUIREMENTS

___ I. Routine Report: Method Blank, Surrogate, as required

___ II. Report Dup., MS, MSD as required

X III. Data Validation Report (includes all raw data)

___ IV. CLP Deliverable Report

___ V. EDD

INVOICE INFORMATION

P.O. # ______

Bill To: ______

TURNAROUND REQUIREMENTS

___ 24 hr. ___ 48 hr.

___ 5 Day

X Standard (15 working days)

___ Provide FAX Results

______ Requested Report Date

Circle which metals are to be analyzed:

SMS Metals: As Cd Cr Cu Pb Hg Ag Zn
CA Metals: Ag As Cd Cr Cu Hg Ni Pb Se Zn
SEM Metals: Cd Cu Pb Hg Ni Zn

SPECIAL INSTRUCTIONS/COMMENTS:
Archive Remaining materials
Refer to T115 Post Dredge Subsurface QAPP
For SVOC's SIM for PAH only.

RELINQUISHED BY:		RECEIVED BY:		RELINQUISHED BY:		RECEIVED BY:	
[signature]	3/12/10 14:30	[signature]					
Signature	Date/Time	Signature	Date/Time	Signature	Date/Time	Signature	Date/Time
DAVID BROWNING	BIS/SEE						
Printed Name	Firm	Printed Name	Firm	Printed Name	Firm	Printed Name	Firm

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Sediment and Tissue Chemistry

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SR#: _____

PAGE 1 OF 2 COC # _____

PROJECT NAME: Part of Seattle T115 Post-Cap

PROJECT NUMBER: Tim Thompson / Mingfu Lin

PROJECT MANAGER: ↓

COMPANY/ADDRESS: 4401 LATONA AVE NE SEATTLE WA 98105

EMAIL: tthompson@seeuc.com

PHONE #: 206-418-6173

FAX #: 206-418-6187

SAMPLER'S SIGNATURE

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	☐ Total Volatile Solids	☒ Total Solids	TOC ☐ (ASTM D4129M) ☒ PSEP	Grain size ☒ PSEP ☐ ASTM D422	Sulfide ☐ Total (9030M) ☐ AVS	☐ PSEP ☐ Water Soluble ☐ SEM (metals list below)	Ammonia ☐ Total (350.1m)	☐ Plumb ☐ Pore water Metals (list below)	Pesticides (8081-L)	PCBs (8082-L) ☐ Aroclors ☐ Congeners	Semivolatiles ☒ PAH GC/MS SIM ☐ 8270-L	Organotins ☐ Bulk ☐ Pore Water	Volatiles (8260) ☐ TBT only	Dioxins ☒ 1613 ☐ 8290	☐ NWTPH ☐ 8015 ☐ GRO ☐ DRO ☐ RRO	☐ Lipids	Tissue Sample Preparation (Instructions below)	ARCHIVE			REMARKS
T115 SG01A100310	3/10/10	09:10		SD	4	X	X	X								X			X				X			
T115 SG01B100310		9:10			4																		X			
T115 SG01C100310		9:10			1																		X			
T115 SG02A100310		10:11			6	X	X	X								X			X				X			MS/MSD
T115 SG02B100310		10:11			1																		X			
T115 SG02C100310		10:11			1																		X			
T115 SG03A100310		11:06			4	X	X	X								X			X				X			
T115 SG03B100310		11:06			1																		X			
T115 SG03C100310	↓	11:06		↓	1																		X			

REPORT REQUIREMENTS

___ I. Routine Report: Method Blank, Surrogate, as required

___ II. Report Dup., MS, MSD as required

X III. Data Validation Report (includes all raw data)

___ IV. CLP Deliverable Report

___ V. EDD

INVOICE INFORMATION

P.O. # _____

Bill To: _____

TURNAROUND REQUIREMENTS

____ 24 hr. ____ 48 hr.

____ 5 Day

X Standard (15 working days)

____ Provide FAX Results

Requested Report Date

Circle which metals are to be analyzed:

SMS Metals: As Cd Cr Cu Pb Hg Ag Zn

CA Metals: Ag As Cd Cr Cu Hg Ni Pb Se Zn

SEM Metals: Cd Cu Pb Hg Ni Zn

SPECIAL INSTRUCTIONS/COMMENTS:

Archive Remaining Materials

Refer to T115 Post Cap Monitoring Plan QAPP

SIM for PAH only

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature: [signature]	Signature:	Signature:	Signature:
Date/Time: 14:30 / 5/12/10	Date/Time:	Date/Time:	Date/Time:
Printed Name: [illegible]	Printed Name:	Printed Name:	Printed Name:
Firm: B&S/SCC	Firm:	Firm:	Firm:

COCSTC 7-04

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Sediment and Tissue Chemistry

1317 South 13th Ave. • Kelso, WA 98626 • (360) 577-7222 • FAX (360) 636-1068

SR#: _____

PAGE 2 OF 2 COC # _____

PROJECT NAME: T115 Port of Seattle T115 Post GAP

PROJECT NUMBER:

PROJECT MANAGER: Tim Thompson / MingTa Lin

COMPANY/ADDRESS: 4401 LATONA AVE NE SEATTLE WA 98105

EMAIL: tthompson@SEELEC.com

PHONE #: 206-418-6173

FAX #: 206-418-6187

SAMPLER'S SIGNATURE:

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	☐ Total Volatile Solids ☒ Total Solids	TOC ☐ (ASTM D4129M) ☒ PSEP	Grain size ☒ PSEP ☐ ASTM D422	Sulfide ☐ Total (9030M) ☐ AVS	☐ PSEP ☐ Water Soluble ☐ SEM (metals list below)	Ammonia ☐ Total (350.1m)	☐ Plumb ☐ Pore water Metals (list below)	Pesticides (8081-L)	PCBs (8082-L) ☐ Aroclors ☐ Congeners	Semivolatiles ☒ PAH GC/MS SIM ☐ 8270-L	Organotins ☐ Bulk ☐ Pore Water ☐ TBT only	Volatiles (8260)	Dioxins ☒ 1613 ☐ 8290	☐ NWTPH ☐ 8015 ☐ GRO ☐ DRO ☐ RRO	☐ Lipids	Tissue Sample Preparation (Instructions below)	ARCHIVE			REMARKS
T115SG04A100310	3/10/10	13:27		SO	4	X	X	X							X			X				X				
T115SG04B100310	↓	13:27		↓	1																	X				
T115SG04C100310	↓	13:27		↓	1																	X				

REPORT REQUIREMENTS

___ I. Routine Report: Method Blank, Surrogate, as required

___ II. Report Dup., MS, MSD as required

X III. Data Validation Report (includes all raw data)

___ IV. CLP Deliverable Report

___ V. EDD

INVOICE INFORMATION

P.O. # _____

Bill To: _____

TURNAROUND REQUIREMENTS

____ 24 hr. ____ 48 hr.

____ 5 Day

X Standard (15 working days)

____ Provide FAX Results

_____ Requested Report Date

Circle which metals are to be analyzed:

SMS Metals: As Cd Cr Cu Pb Hg Ag Zn

CA Metals: Ag As Cd Cr Cu Hg Ni Pb Se Zn

SEM Metals: Cd Cu Pb Hg Ni Zn

SPECIAL INSTRUCTIONS/COMMENTS:

SEE PREVIOUS PAGE

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature: 3/12/10 14:30	Signature: 3/10/10 14:30	Signature:	Signature:
Date/Time	Date/Time	Date/Time	Date/Time
Printed Name: David Downs	Printed Name:	Printed Name:	Printed Name:
Firm: SES/SEE	Firm:	Firm:	Firm:

COCSTC 7-04

Appendix F

Subsurface Sediment Samples Comparison to DMMP Criteria

Appendix F
Table F-1 Station SC01

Chemical Name	SQS (ppm OC)	CSL (ppm OC)	SL	BT	ML	LAET	2AET	Station													
								SC01 ZA 1/27/2010 9:44				SC01 ZB 1/27/2010 9:44				SC01 ZC 1/27/2010 9:44				SC01 ZD 1/27/2010 9:44			
								Valid Result	Result Unit	Valid Flag	TOC NormConc (ppm OC)	Valid Result	Result Unit	Valid Flag	TOC NormConc (ppm OC)	Valid Result	Result Unit	Valid Flag	TOC NormConc (ppm OC)	Valid Result	Result Unit	Valid Flag	TOC NormConc (ppm OC)
Solids, Total								52.5	percent														
Solids, Total								52.8	percent			60.7	percent			64.1	percent			74.7	percent		
Carbon, Total Organic (TOC)								2.15	percent			1.54	percent			4.69	percent			1.01	percent		
Gravel								1.7	percent			1.67	percent			2.28	percent			13.9	percent		
Sand, Very Coarse								1.08	percent			1.6	percent			1.57	percent			5.05	percent		
Sand, Coarse								2.61	percent			4.42	percent			3.51	percent			8.78	percent		
Sand, Medium								8.97	percent			17.3	percent			9.89	percent			13	percent		
Sand, Fine								7.93	percent			16.5	percent			11.1	percent			9.48	percent		
Sand, Very Fine								8.85	percent			11.2	percent			11	percent			7.53	percent		
Silt								59.3	percent			35.3	percent			52.2	percent			30.6	percent		
Clay								11.3	percent			15.4	percent			10.6	percent			8.71	percent		
LPAH	370	780	5200	—	29000	5.2	13	213			9.91	306			19.87	923			19.68	893			88.42
Naphthalene	99	170	2100	—	2400	2.1	2.4	12	µg/kg		0.56	40	µg/kg		2.60	25	µg/kg	D	0.53	35	µg/kg	D	3.47
Acenaphthylene	66	66	560	—	1300	1.3	1.3	15	µg/kg		0.70	21	µg/kg		1.36	28	µg/kg	D	0.60	28	µg/kg		2.77
Acenaphthene	16	57	500	—	2000	0.50	0.73	13	µg/kg		0.60	23	µg/kg		1.49	160	µg/kg	D	3.41	220	µg/kg	D	**21.78**
Fluorene	23	79	540	—	3600	0.54	1.0	16	µg/kg		0.74	25	µg/kg		1.62	110	µg/kg	D	2.35	150	µg/kg	D	14.85
Phenanthrene	100	480	1500	—	21000	1.5	5.4	110	µg/kg		5.12	130	µg/kg		8.44	270	µg/kg	D	5.76	200	µg/kg	D	19.80
Anthracene	220	1200	960	—	13000	0.96	4.4	47	µg/kg		2.19	67	µg/kg		4.35	330	µg/kg	D	7.04	260	µg/kg	D	25.74
2-Methylnaphthalene	38	64	670	—	1900	0.67	1.4	8.5	µg/kg		0.40	28	µg/kg		1.82	24	µg/kg	D	0.51	34	µg/kg	U	3.37
HPAH	960	5300	12000	4600	69000	12	17	1873			87.12	2794			181.43	4733			100.92	8236			815.45
Fluoranthene	160	1200	1700	11980	30000	1.7	2.5	280	µg/kg		13.02	310	µg/kg		20.13	1200	µg/kg	D	25.59	*2700*	µg/kg	D	**267.33**
Pyrene	1000	1400	2600	—	16000	2.6	3.3	430	µg/kg		20.00	1100	µg/kg	D	71.43	1300	µg/kg	D	27.72	*2600*	µg/kg	D	257.43
Benz(a)anthracene	110	270	1300	—	5100	1.3	1.6	130	µg/kg		6.05	140	µg/kg		9.09	400	µg/kg	D	8.53	780	µg/kg	D	77.23
Chrysene	110	460	1400	—	21000	1.4	2.8	200	µg/kg		9.30	200	µg/kg		12.99	610	µg/kg	D	13.01	940	µg/kg	D	93.07
Benzo(b)fluoranthene								290	µg/kg		13.49	390	µg/kg		25.32	440	µg/kg	D	9.38	490	µg/kg	D	48.51
Benzo(k)fluoranthene								94	µg/kg		4.37	120	µg/kg		7.79	150	µg/kg	D	3.20	180	µg/kg	D	17.82
Total Benzofluoranthenes	230	450	3200		9900	3.2	3.6	384			17.86	510			33.12	590			12.58	670			66.34
Benzo(a)pyrene	99	210	1600		3600	1.6	3.0	170	µg/kg		7.91	250	µg/kg		16.23	290	µg/kg	D	6.18	300	µg/kg	D	29.70
Indeno(1,2,3-cd)pyrene	34	88	600		4400	0.6	0.69	120	µg/kg		5.58	130	µg/kg		8.44	150	µg/kg	D	3.20	120	µg/kg	D	11.88
Dibenz(a,h)anthracene	12	33	230		1900	0.23	0.54	29	µg/kg		1.35	34	µg/kg		2.21	43	µg/kg	D	0.92	33	µg/kg		3.27
Benzo(g,h,i)perylene	31	78	670		3200	0.67	0.72	130	µg/kg		6.05	120	µg/kg		7.79	150	µg/kg	D	3.20	93	µg/kg	D	9.21
Chlorinated Organics																							
1,2-Dichlorobenzene	2.3	2.3	35		110	0.035	0.050	9.6	µg/kg	U	0.45	8.3	µg/kg	U	0.54	39	µg/kg	U	0.83	*67*	µg/kg	U	***6.63***
1,3-Dichlorobenzene			170					9.6	µg/kg	U	0.45	8.3	µg/kg	U	0.54	39	µg/kg	U	0.83	67	µg/kg	U	6.63
1,4-Dichlorobenzene	3.1	9	110		120	0.11	0.12	9.6	µg/kg	U	0.45	8.3	µg/kg	U	0.54	39	µg/kg	U	0.83	67	µg/kg	U	**6.63**
1,2,4-Trichlorobenzene	0.81	1.8	31		64	0.031	0.051	9.6	µg/kg	U	0.45	8.3	µg/kg	U	0.54	39	µg/kg	U	**0.83**	*67*	µg/kg	U	***6.63***
Hexachlorobenzene	0.38	2.3	22	168	230	0.022	0.070	9.6	µg/kg	U	**0.45**	8.3	µg/kg	U	**0.54**	39	µg/kg	U	**0.83**	67	µg/kg	U	***6.63***
Phthalate Esters																							
Dimethyl Phthalate	53	53	71		1400	0.071	0.16	15	µg/kg	U	0.70	11	µg/kg	U	0.71	39	µg/kg	U	0.83	67	µg/kg	U	6.63
Diethyl Phthalate	61	110	200		1200	0.2	1.2	9.6	µg/kg	U	0.45	8.3	µg/kg	U	0.54	39	µg/kg	U	0.83	67	µg/kg	U	6.63
Di-n-butyl Phthalate	220	1700	1400		5100	1.4	5.1	13	µg/kg	J	0.60	20	µg/kg		1.30	40	µg/kg	J	0.85	140	µg/kg	U	13.86
Butyl Benzyl Phthalate	4.9	64	63		970	0.063	0.9	40	µg/kg		1.86	140	µg/kg		**9.09**	50	µg/kg	D	1.07	*67*	µg/kg	U	**6.63**
Bis(2-ethylhexyl) Phthalate	47	78	1300		8300	1.3	3.1	590	µg/kg		27.44	730	µg/kg		**47.40**	410	µg/kg	D	8.74	76	µg/kg	J	7.52
Di-n-octyl Phthalate	58	4500	6200		6200	6.2	6.2	18	µg/kg	U	0.84	20	µg/kg	U	1.30	39	µg/kg	U	0.83	67	µg/kg	U	6.63
Dibenzofuran	15	58	540		1700	0.54	0.70	11	µg/kg		0.51	17	µg/kg		1.10	61	µg/kg	D	1.30	84	µg/kg	D	8.32
Hexachlorobutadiene	3.9	6.2				0.011	0.12	9.6	µg/kg	U	0.45	8.3	µg/kg	U	0.54	39	µg/kg	U	0.83	67	µg/kg	U	***6.63***
N-Nitrosodiphenylamine	11	11	28		130	0.028	0.040	3.5	µg/kg	J	0.16	8.3	µg/kg	U	0.54	39	µg/kg	U	0.83	*67*	µg/kg	U	6.63

Appendix F
Table F-1 Station SC01

Chemical Name	SQS (ppm OC)	CSL (ppm OC)	SL	BT	ML	LAET	2AET	Station: SC01 ZA 1/27/2010 9:44 Valid Result	Result Unit	Valid Flag	TOC NormConc (ppm OC)	SC01 ZB 1/27/2010 9:44 Valid Result	Result Unit	Valid Flag	TOC NormConc (ppm OC)	SC01 ZC 1/27/2010 9:44 Valid Result	Result Unit	Valid Flag	TOC NormConc (ppm OC)	SC01 ZD 1/27/2010 9:44 Valid Result	Result Unit	Valid Flag	TOC NormConc (ppm OC)
Total PCBs	12	65	130	38	3100	6.2	6.2	*330*			**15.35**	*333*			**21.62**	*590*			**12.58**	*425*			**42.08**
Aroclor 1016								9.6	µg/kg	U		8.3	µg/kg	U		7.8	µg/kg	U		6.7	µg/kg	U	
Aroclor 1221								20	µg/kg	U		17	µg/kg	U		16	µg/kg	U		14	µg/kg	U	
Aroclor 1232								9.6	µg/kg	U		8.3	µg/kg	U		7.8	µg/kg	U		6.7	µg/kg	U	
Aroclor 1242								50	µg/kg			83	µg/kg			170	µg/kg			120	µg/kg		
Aroclor 1248								9.6	µg/kg	U		8.3	µg/kg	U		7.8	µg/kg	U		6.7	µg/kg	U	
Aroclor 1254								110	µg/kg			140	µg/kg			260	µg/kg			210	µg/kg		
Aroclor 1260								170	µg/kg	J		110	µg/kg	J		160	µg/kg	J		95	µg/kg	J	
	SQS (µg/kg)	**CSL (µg/kg)**	**SL**	**BT**	**ML**																		
Phenol	420	1200	420		1200	0.42	1.2	18	µg/kg	J		13	µg/kg	J		120	µg/kg	U		210	µg/kg	U	
2-Methylphenol	63	63	63		77	0.063	0.072	9.6	µg/kg	U		8.3	µg/kg	U		39	µg/kg	U		*67*	µg/kg	U	
4-Methylphenol	670	670	670		3600	0.67	1.8	9.6	µg/kg	U		6.8	µg/kg	J		39	µg/kg	U		67	µg/kg	U	
2,4-Dimethylphenol	29	29	29		210	0.029	0.072	*48*	µg/kg	U		7	µg/kg	J		*200*	µg/kg	U		***340***	µg/kg	U	
Pentachlorophenol (PCP)	360	690	400	504	690	0.36	0.69	96	µg/kg	U		31	µg/kg	J		*390*	µg/kg	U		*670*	µg/kg	U	
Benzyl Alcohol	57	73	57		870	0.057	0.073	24	µg/kg			7.6	µg/kg	J		*78*	µg/kg	U		*140*	µg/kg	U	
Benzoic Acid	650	650	650		760	0.65	0.65	100	µg/kg	J		170	µg/kg	U		***780***	µg/kg	U		***1400***	µg/kg	U	
Hexachloroethane			1400		14000			9.6	µg/kg	U		8.3	µg/kg	U		39	µg/kg	U		67	µg/kg	U	
Phenol-d6																							
Nitrobenzene-d5																							
2-Fluorobiphenyl																							
2,4,6-Tribromophenol																							
p-Terphenyl-d14			4 TEQ Total	10 TEQ Volume Weighted			Total TEQ	2.61092			Total TEQ	***20.2317***			Total TEQ	***24.0247***			Total TEQ	*6.3896*			
						Total TEQ (1/2U)		*4.038*			Total TEQ (1/2U)	***21.2071***			Total TEQ (1/2U)	***24.8279***			Total TEQ (1/2U)	*6.9986*			
						Dioxin TEQ (0U)		2.0204			Dioxin TEQ (0U)	16.826			Dioxin TEQ (0U)	21.57			Dioxin TEQ (0U)	4.8738			
						Dioxin TEQ (1/2U)		2.8204			Dioxin TEQ (1/2U)	16.826			Dioxin TEQ (1/2U)	21.57			Dioxin TEQ (1/2U)	4.8738			
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)								1.6	ng/Kg	U		0.833	ng/Kg	J		0.619	ng/Kg	J		0.223	ng/Kg	J	
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)								0.332	ng/Kg	J		2.49	ng/Kg	J		2.41	ng/Kg	J		0.523	ng/Kg	J	
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)								0.589	ng/Kg	J		3.09	ng/Kg	J		3.56	ng/Kg	J		0.818	ng/Kg	J	
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)								3.24	ng/Kg	J		22.8	ng/Kg			31.9	ng/Kg			5.7	ng/Kg	J	
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)								1.7	ng/Kg			15.2	ng/Kg			18	ng/Kg			3.83	ng/Kg	J	
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)								89.1	ng/Kg			739	ng/Kg			1060	ng/Kg			237	ng/Kg		
Octachlorodibenzo-p-dioxin (OCDD)								815	ng/Kg			6680	ng/Kg	J		8650	ng/Kg	J		2410	ng/Kg		
						Furan TEQ (0U)		0.59052			Furan TEQ (0U)	3.40567			Furan TEQ (0U)	2.45471			Furan TEQ (0U)	1.51581			
						Furan TEQ (1/2U)		1.21755			Furan TEQ (1/2U)	4.38107			Furan TEQ (1/2U)	3.25791			Furan TEQ (1/2U)	2.12481			
2,3,7,8-Tetrachlorodibenzofuran (TCDF)								0.374	ng/Kg	J		1.46	ng/Kg			1.21	ng/Kg	J		0.342	ng/Kg	J	
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)								8.01	ng/Kg	U		0.969	ng/Kg	J		0.787	ng/Kg	J		0.337	ng/Kg	J	
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)								0.411	ng/Kg	J		2.03	ng/Kg	J		1.56	ng/Kg	J		0.938	ng/Kg	J	
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)								1.54	ng/Kg	J		9.14	ng/Kg			7.43	ng/Kg	J		6	ng/Kg	J	
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)								0.624	ng/Kg	J		3.92	ng/Kg	J		2.13	ng/Kg	J		1.24	ng/Kg	J	
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)								8.01	ng/Kg	U		6.71	ng/Kg	U		7.64	ng/Kg	U		6.24	ng/Kg	U	
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)								0.872	ng/Kg	J		4.06	ng/Kg	J		2.86	ng/Kg	J		1.43	ng/Kg	J	
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)								10.7	ng/Kg			79.5	ng/Kg			52.3	ng/Kg			26.8	ng/Kg		
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)								0.74	ng/Kg	J		4.35	ng/Kg	J		3.03	ng/Kg	J		2.21	ng/Kg	J	
Octachlorodibenzofuran (OCDF)								39.4	ng/Kg			237	ng/Kg			156	ng/Kg			110	ng/Kg		
Tetrachlorodibenzo-p-dioxins (TCDD), Total								1.6	ng/Kg	U		3.77	ng/Kg			2.26	ng/Kg			0.388	ng/Kg	J	
Pentachlorodibenzo-p-dioxin (PeCDD), Total								0.57	ng/Kg	J		19.5	ng/Kg			16	ng/Kg			2.98	ng/Kg	J	
Hexachlorodibenzo-p-dioxins (HxCDD), Total								22.9	ng/Kg			204	ng/Kg			274	ng/Kg			58.9	ng/Kg		
Heptachlorodibenzo-p-dioxins (HpCDD), Total								297	ng/Kg			1980	ng/Kg			2870	ng/Kg			809	ng/Kg		
Tetrachlorodibenzofurans (TCDF), Total								1.26	ng/Kg	J		30	ng/Kg			16.8	ng/Kg			5.49	ng/Kg		
Pentachlorodibenzofurans (PeCDF), Total								6.45	ng/Kg	J		56.1	ng/Kg			38.3	ng/Kg			14.8	ng/Kg		
Hexachlorodibenzofurans (HxCDF), Total								18.5	ng/Kg			137	ng/Kg			83.5	ng/Kg			44.5	ng/Kg		
Heptachlorodibenzofurans (HpCDF), Total								39.9	ng/Kg			288	ng/Kg			206	ng/Kg			117	ng/Kg		

Appendix F
Table F-1 Station SC01

Chemical Name	SQS (ppm OC)	CSL (ppm OC)	SL	BT	ML	LAET	2AET	Station													
								SC01 ZA 1/27/2010 9:44				SC01 ZB 1/27/2010 9:44				SC01 ZC 1/27/2010 9:44				SC01 ZD 1/27/2010 9:44			
								Valid Result	Result Unit	Valid Flag	TOC NormConc (ppm OC)	Valid Result	Result Unit	Valid Flag	TOC NormConc (ppm OC)	Valid Result	Result Unit	Valid Flag	TOC NormConc (ppm OC)	Valid Result	Result Unit	Valid Flag	TOC NormConc (ppm OC)
2,3,7,8-Tetrachlorodibenzo-p-dioxin-C13																							
1,2,3,7,8-Pentachlorodibenzo-p-dioxin-C13																							
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin-C13																							
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin-C13																							
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin-C13																							
Octachlorodibenzo-p-dioxin-C13																							
2,3,7,8-Tetrachlorodibenzofuran-C13																							
1,2,3,7,8-Pentachlorodibenzofuran-C13																							
2,3,4,7,8-Pentachlorodibenzofuran-C13																							
1,2,3,4,7,8-Hexachlorodibenzofuran-C13																							
1,2,3,6,7,8-Hexachlorodibenzofuran-C13																							
1,2,3,7,8,9-Hexachlorodibenzofuran-C13																							
2,3,4,6,7,8-Hexachlorodibenzofuran-C13																							
1,2,3,4,6,7,8-Heptachlorodibenzofuran-C13																							
1,2,3,4,7,8,9-Heptachlorodibenzofuran-C13																							

Notes:
J - The analyte was detected above the reported quantitation limit, and the reported concentration was an estimated value.
R - The result was rejected and could not be used.
U - The analyte was analyzed for, but was considered not detected at the reporting limit or reported value.
UJ - The analyte was analyzed for, and the associated quantitation limit was an estimated value.

Double border indicates DMMP bioaccumulation trigger

A heavy border with *italicized font* indicates DMMP screening level

A heavy border with ***bold, italicized font*** indicates DMMP maximum level

Appendix F
Table F-2 Station SC02

Chemical Name	SQS (ppm OC)	CSL (ppm 0C)	SL	BT	ML	LAET	2AET	Station													
								SC02-ZA 1/27/2010 11:11				SC02-ZB 1/27/2010 11:11				SC02-ZC 1/27/2010 11:11				SC02-ZD 1/27/2010 11:11			
								Valid Result	Result Unit	Valid Flag	TOC NormConc (ppm OC)	Valid Result	Result Unit	Valid Flag	TOC NormConc (ppm OC)	Valid Result	Result Unit	Valid Flag	TOC NormConc (ppm OC)	Valid Result	Result Unit	Valid Flag	TOC NormConc (ppm OC)
Solids, Total								52.9	percent			61.2	percent			60	percent			59.8	percent		
Carbon, Total Organic (TOC)								2.44	percent			1.94	percent			1.6	percent			2.19	percent		
Gravel								0.25	percent			1.39	percent			0.49	percent			0	percent		
Sand, Very Coarse								0.68	percent			0.29	percent			0.14	percent			0.09	percent		
Sand, Coarse								1.61	percent			1.46	percent			0.6	percent			0.25	percent		
Sand, Medium								5.97	percent			5.72	percent			5.37	percent			1.91	percent		
Sand, Fine								5.53	percent			11.9	percent			8.58	percent			3.82	percent		
Sand, Very Fine								9.86	percent			10.9	percent			7.97	percent			13.3	percent		
Silt								65.8	percent			60.1	percent			36.9	percent			57.6	percent		
Clay								10.5	percent			12.2	percent			37.3	percent			24.7	percent		
LPAH	370	780	5200	—	29000	5.2	13	284			11.64	376			19.38	217.8			13.61	1904			86.94
Naphthalene	99	170	2100	—	2400	2.1	2.4	48	µg/kg	U	1.97	21	µg/kg	U	1.08	12	µg/kg		0.75	30	µg/kg		1.37
Acenaphthylene	66	66	560	—	1300	1.3	1.3	29	µg/kg		1.19	18	µg/kg		0.93	5.8	µg/kg		0.36	44	µg/kg		2.01
Acenaphthene	16	57	500	—	2000	0.50	0.73	17	µg/kg		0.70	23	µg/kg		1.19	21	µg/kg		1.31	150	µg/kg		6.85
Fluorene	23	79	540	—	3600	0.54	1.0	27	µg/kg		1.11	31	µg/kg		1.60	25	µg/kg		1.56	200	µg/kg		9.13
Phenanthrene	100	480	1500	—	21000	1.5	5.4	140	µg/kg		5.74	220	µg/kg		11.34	120	µg/kg		7.50	1100	µg/kg		50.23
Anthracene	220	1200	960	—	13000	0.96	4.4	71	µg/kg		2.91	84	µg/kg		4.33	34	µg/kg		2.13	380	µg/kg		17.35
2-Methylnaphthalene	38	64	670	—	1900	0.67	1.4	48	µg/kg	U	1.97	21	µg/kg	U	1.08	7.8	µg/kg		0.49	21	µg/kg		0.96
HPAH	960	5300	12000	4600	69000	12	17	3127			128.16	2239			115.41	866			54.13	5381			245.71
Fluoranthene	160	1200	1700	11980	30000	1.7	2.5	350	µg/kg		14.34	400	µg/kg		20.62	230	µg/kg		14.38	1300	µg/kg		59.36
Pyrene	1000	1400	2600	—	16000	2.6	3.3	800	µg/kg		32.79	520	µg/kg		26.80	190	µg/kg		11.88	990	µg/kg		45.21
Benz(a)anthracene	110	270	1300	—	5100	1.3	1.6	230	µg/kg		9.43	200	µg/kg		10.31	73	µg/kg		4.56	530	µg/kg		24.20
Chrysene	110	460	1400	—	21000	1.4	2.8	380	µg/kg		15.57	290	µg/kg		14.95	87	µg/kg		5.44	760	µg/kg		34.70
Benzo(b)fluoranthene								490	µg/kg		20.08	260	µg/kg		13.40	92	µg/kg		5.75	580	µg/kg		26.48
Benzo(k)fluoranthene								170	µg/kg		6.97	100	µg/kg		5.15	31	µg/kg		1.94	220	µg/kg		10.05
Total Benzofluoranthenes	230	450	3200		9900	3.2	3.6	660			27.05	360			18.56	123			7.69	800			36.53
Benzo(a)pyrene	99	210	1600		3600	1.6	3.0	290	µg/kg		11.89	190	µg/kg		9.79	64	µg/kg		4.00	410	µg/kg		18.72
Indeno(1,2,3-cd)pyrene	34	88	600		4400	0.6	0.69	190	µg/kg		7.79	120	µg/kg		6.19	42	µg/kg		2.63	270	µg/kg		12.33
Dibenz(a,h)anthracene	12	33	230		1900	0.23	0.54	47	µg/kg		1.93	29	µg/kg		1.49	11	µg/kg		0.69	71	µg/kg		3.24
Benzo(g,h,i)perylene	31	78	670		3200	0.67	0.72	180	µg/kg		7.38	130	µg/kg		6.70	46	µg/kg		2.88	250	µg/kg		11.42
1,2-Dichlorobenzene	2.3	2.3	35		110	0.035	0.050	*95*	µg/kg	U	***3.89***	*41*	µg/kg	U	2.11	8.4	µg/kg	U	0.53	8.4	µg/kg	U	0.38
1,3-Dichlorobenzene			170					95	µg/kg	U	3.89	41	µg/kg	U	2.11	8.4	µg/kg	U	0.53	8.4	µg/kg	U	0.38
1,4-Dichlorobenzene	3.1	9	110		120	0.11	0.12	95	µg/kg	U	**3.89**	41	µg/kg	U	2.11	8.4	µg/kg	U	0.53	8.4	µg/kg	U	0.38
1,2,4-Trichlorobenzene	0.81	1.8	31		64	0.031	0.051	***95***	µg/kg	U	***3.89***	*41*	µg/kg	U	2.11	8.4	µg/kg	U	0.53	8.4	µg/kg	U	0.38
Hexachlorobenzene	0.38	2.3	22	168	230	0.022	0.070	95	µg/kg	U	***3.89***	41	µg/kg	U	2.11	8.4	µg/kg	U	0.53	8.4	µg/kg	U	0.38
Dimethyl Phthalate	53	53	71		1400	0.071	0.16	*95*	µg/kg	U	3.89	41	µg/kg	U	2.11	8.4	µg/kg	U	0.53	8.4	µg/kg	U	0.38
Diethyl Phthalate	61	110	200		1200	0.2	1.2	95	µg/kg	U	3.89	41	µg/kg	U	2.11	8.4	µg/kg	U	0.53	8.4	µg/kg	U	0.38
Di-n-butyl Phthalate	220	1700	1400		5100	1.4	5.1	190	µg/kg	U	7.79	82	µg/kg	U	4.23	17	µg/kg	U	1.06	11	µg/kg	J	0.50
Butyl Benzyl Phthalate	4.9	64	63		970	0.063	0.9	*95*	µg/kg	U	3.89	*100*	µg/kg		5.15	17	µg/kg		1.06	42	µg/kg		1.92
Bis(2-ethylhexyl) Phthalate	47	78	1300		8300	1.3	3.1	520	µg/kg		21.31	550	µg/kg	D	28.35	140	µg/kg		8.75	270	µg/kg		12.33
Di-n-octyl Phthalate	58	4500	6200		6200	6.2	6.2	95	µg/kg	U	3.89	41	µg/kg	U	2.11	8.4	µg/kg	U	0.53	8.4	µg/kg	U	0.38
Dibenzofuran	15	58	540		1700	0.54	0.70	95	µg/kg	U	3.89	13	µg/kg		0.67	14	µg/kg		0.88	85	µg/kg		3.88
Hexachlorobutadiene	3.9	6.2				0.011	0.12	95	µg/kg	U	3.89	41	µg/kg	U	2.11	8.4	µg/kg	U	0.53	8.4	µg/kg	U	0.38
N-Nitrosodiphenylamine	11	11	28		130	0.028	0.040	*95*	µg/kg	U	3.89	*41*	µg/kg	U	2.11	8.4	µg/kg	U	0.53	8.4	µg/kg	U	0.38
PCB 209	12	65	130	38	3100	6.2	6.2	*349*			14.30	*294*			15.15	112			7.00	*214*			9.77
Aroclor 1016								9.5	µg/kg	U		8.2	µg/kg	U		8.4	µg/kg	U		8.4	µg/kg	U	
Aroclor 1221								19	µg/kg	U		17	µg/kg	U		17	µg/kg	U		17	µg/kg	U	
Aroclor 1232								9.5	µg/kg	U		8.2	µg/kg	U		8.4	µg/kg	U		8.4	µg/kg	U	
Aroclor 1242								79	µg/kg			61	µg/kg			23	µg/kg			56	µg/kg		
Aroclor 1248								9.5	µg/kg	U		8.2	µg/kg	U		8.4	µg/kg	U		8.4	µg/kg	U	
Aroclor 1254								150	µg/kg			140	µg/kg			51	µg/kg			87	µg/kg		
Aroclor 1260								120	µg/kg	J		93	µg/kg	J		38	µg/kg	J		71	µg/kg	J	
	SQS (µg/kg)	**CSL (µg/kg)**	**SL**	**BT**	**ML**																		
Phenol	420	1200	420		1200	0.42	1.2	290	µg/kg	U		130	µg/kg	U		2.4	µg/kg	J		8.6	µg/kg	J	
2-Methylphenol	63	63	63		77	0.063	0.072	***95***	µg/kg	U		41	µg/kg	U		8.4	µg/kg	U		8.4	µg/kg	U	
4-Methylphenol	670	670	670		3600	0.67	1.8	30	µg/kg			41	µg/kg	U		8.4	µg/kg	U		8.4	µg/kg	U	
2,4-Dimethylphenol	29	29	29		210	0.029	0.072	***480***	µg/kg	U		***210***	µg/kg	U		*42*	µg/kg	U		*42*	µg/kg	U	
Pentachlorophenol (PCP)	360	690	400	504	690	0.36	0.69	***950***	µg/kg	U		*410*	µg/kg	U		84	µg/kg	U		84	µg/kg	U	
Benzyl Alcohol	57	73	57		870	0.057	0.073	*190*	µg/kg	U		*82*	µg/kg	U		17	µg/kg	U		4.2	µg/kg	J	
Benzoic Acid	650	650	650		760	0.65	0.65	***1900***	µg/kg	U		***820***	µg/kg	U		170	µg/kg	U		170	µg/kg	U	
Hexachloroethane			1400		14000			95	µg/kg	U		41	µg/kg	U		8.4	µg/kg	U		8.4	µg/kg	U	

Appendix F
Table F-2 Station SC02

Chemical Name	SQS (ppm OC)	CSL (ppm 0C)	SL	BT	ML	LAET	2AET	Station													
								SC02-ZA 1/27/2010 11:11				SC02-ZB 1/27/2010 11:11				SC02-ZC 1/27/2010 11:11				SC02-ZD 1/27/2010 11:11			
								Valid Result	Result Unit	Valid Flag	TOC NormConc (ppm OC)	Valid Result	Result Unit	Valid Flag	TOC NormConc (ppm OC)	Valid Result	Result Unit	Valid Flag	TOC NormConc (ppm OC)	Valid Result	Result Unit	Valid Flag	TOC NormConc (ppm OC)
Phenol-d6																							
Nitrobenzene-d5																							
2-Fluorobiphenyl																							
2,4,6-Tribromophenol																							
p-Terphenyl-d14							Total TEQ	*8.0992*			Total TEQ	*6.3398*			Total TEQ	*5.5402*			Total TEQ	***10.0799***			
			4 TEQ	10 TEQ (Volume averaged to 4)			Total TEQ (1/2U)	*9.7457*			Total TEQ (1/2U)	*6.8952*			Total TEQ (1/2U)	*6.0161*			Total TEQ (1/2U)	***10.7841***			
							Dioxin TEQ (0U)	6.275			Dioxin TEQ (0U)	5.168			Dioxin TEQ (0U)	4.6531			Dioxin TEQ (0U)	8.595			
							Dioxin TEQ (1/2U)	7.165			Dioxin TEQ (1/2U)	5.168			Dioxin TEQ (1/2U)	4.6531			Dioxin TEQ (1/2U)	8.595			
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)								1.78	ng/Kg	U		0.354	ng/Kg	J		0.409	ng/Kg			0.42	ng/Kg	J	
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)								0.907	ng/Kg	J		0.779	ng/Kg	J		0.868	ng/Kg	J		1.2	ng/Kg	J	
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)								1.39	ng/Kg	JK		1.14	ng/Kg	J		0.781	ng/Kg			1.49	ng/Kg	J	
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)								9.55	ng/Kg			7.33	ng/Kg			5.63	ng/Kg	J		11.6	ng/Kg		
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)								5.78	ng/Kg	J		4.95	ng/Kg	J		4.39	ng/Kg	J		7.17	ng/Kg	J	
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)								282	ng/Kg	B		212	ng/Kg	B		181	ng/Kg	B		398	ng/Kg		
Octachlorodibenzo-p-dioxin (OCDD)								2920	ng/Kg	B		1910	ng/Kg	B		1620	ng/Kg	B		3230	ng/Kg		
							Furan TEQ (0U)	1.82419			Furan TEQ (0U)	1.17183			Furan TEQ (0U)	0.88713			Furan TEQ (0U)	1.48491			
							Furan TEQ (1/2U)	2.58069			Furan TEQ (1/2U)	1.72724			Furan TEQ (1/2U)	1.36303			Furan TEQ (1/2U)	2.18911			
2,3,7,8-Tetrachlorodibenzofuran (TCDF)								0.773	ng/Kg	J		0.526	ng/Kg	J		0.472	ng/Kg	J		0.698	ng/Kg	J	
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)								0.593	ng/Kg	JK		0.388	ng/Kg	J		0.363	ng/Kg	J		0.547	ng/Kg	J	
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)								0.992	ng/Kg	J		0.644	ng/Kg	JK		0.606	ng/Kg			0.896	ng/Kg	J	
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)								6.11	ng/Kg	J		3.68	ng/Kg	J		2.48	ng/Kg	J		4.53	ng/Kg	J	
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)								1.77	ng/Kg	J		1.3	ng/Kg	J		0.849	ng/Kg	J		1.47	ng/Kg	J	
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)								8.92	ng/Kg	U		7.15	ng/Kg	U		6.98	ng/Kg	U		8.09	ng/Kg	U	
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)								2.3	ng/Kg	J		1.3	ng/Kg	JK		1.28	ng/Kg	J		1.84	ng/Kg	J	
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)								35.6	ng/Kg			24.9	ng/Kg			16.3	ng/Kg			29.6	ng/Kg		
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)								2.3	ng/Kg	J		1.54	ng/Kg	J		0.924	ng/Kg			1.66	ng/Kg		
Octachlorodibenzofuran (OCDF)								115	ng/Kg			73.3	ng/Kg			47	ng/Kg			111	ng/Kg		
Tetrachlorodibenzo-p-dioxins (TCDD), Total								1.78	ng/Kg	U		1.17	ng/Kg	J		0.787	ng/Kg	J		2.02	ng/Kg		
Pentachlorodibenzo-p-dioxin (PeCDD), Total								5.12	ng/Kg	J		1.77	ng/Kg	J		5.64	ng/Kg	J		8.88	ng/Kg		
Hexachlorodibenzo-p-dioxins (HxCDD), Total								67.2	ng/Kg			66.9	ng/Kg			63.8	ng/Kg			107	ng/Kg		
Heptachlorodibenzo-p-dioxins (HpCDD), Total								809	ng/Kg			721	ng/Kg			533	ng/Kg			1140	ng/Kg		
Tetrachlorodibenzofurans (TCDF), Total								4.27	ng/Kg			3.42	ng/Kg			4.04	ng/Kg			9.28	ng/Kg		
Pentachlorodibenzofurans (PeCDF), Total								20.2	ng/Kg			13.6	ng/Kg			10.9	ng/Kg			20.7	ng/Kg		
Hexachlorodibenzofurans (HxCDF), Total								59.3	ng/Kg			39.2	ng/Kg			27.3	ng/Kg			47.8	ng/Kg		
Heptachlorodibenzofurans (HpCDF), Total								132	ng/Kg			88.9	ng/Kg			55.5	ng/Kg			119	ng/Kg		
2,3,7,8-Tetrachlorodibenzo-p-dioxin-C13																							
1,2,3,7,8-Pentachlorodibenzo-p-dioxin-C13																							
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin-C13																							
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin-C13																							
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin-C13																							
Octachlorodibenzo-p-dioxin-C13																							
2,3,7,8-Tetrachlorodibenzofuran-C13																							
1,2,3,7,8-Pentachlorodibenzofuran-C13																							
2,3,4,7,8-Pentachlorodibenzofuran-C13																							
1,2,3,4,7,8-Hexachlorodibenzofuran-C13																							
1,2,3,6,7,8-Hexachlorodibenzofuran-C13																							
1,2,3,7,8,9-Hexachlorodibenzofuran-C13																							
2,3,4,6,7,8-Hexachlorodibenzofuran-C13																							
1,2,3,4,6,7,8-Heptachlorodibenzofuran-C13																							
1,2,3,4,7,8,9-Heptachlorodibenzofuran-C13																							

Notes:
J - The analyte was detected above the reported quantitation limit, and the reported concentration was an estimated value.
R - The result was rejected and could not be used.
U - The analyte was analyzed for, but was considered not detected at the reporting limit or reported value.
UJ - The analyte was analyzed for, and the associated quantitation limit was an estimated value.

Double border indicates DMMP bioaccumulation trigger

A heavy border with *italicized font* indicates DMMP screening level

A heavy border with ***italicized, bold font*** indicates DMMP maximum level

Appendix F
Table F-3 Station SC03

Chemical Name	SQS (ppm OC)	CSL (ppm 0C)	SL	BT	ML	LAET	2AET	Station: SC032-ZA 3/10/2010 12:14 Valid Result	Result Unit	Valid Flag	TOC NormConc (ppm OC)	SC-0-32 ZB 3/10/2010 12:14 Valid Result	Result Unit	Valid Flag	TOC NormConc (ppm OC)	SC-032 ZC 3/10/2010 12:14 (compare to dry wt AET) Valid Result	Result Unit	Valid Flag	TOC NormConc (ppm OC)	SC03 ZD 3/10/2010 12:14 (compare to dry wt AET) Valid Result	Result Unit	Valid Flag	TOC NormConc (ppm OC)
Solids, Total								60.5	percent			69.6	percent			91	percent			87.7	percent		
Carbon, Total Organic (TOC)								1.88	percent			1.3	percent			**0.326**	percent			**0.077**	percent		
Gravel								0.77	percent			2.36	percent			22.4	percent			17.2	percent		
Sand, Very Coarse								1.45	percent			1.41	percent			5.98	percent			7.08	percent		
Sand, Coarse								1.62	percent			5.95	percent			17.7	percent			22.2	percent		
Sand, Medium								3.16	percent			16.1	percent			30.7	percent			39.6	percent		
Sand, Fine								3.62	percent			13.4	percent			12.6	percent			10.5	percent		
Sand, Very Fine								15.7	percent			8.1	percent			4.07	percent			1.44	percent		
Silt								61	percent			38.2	percent			3.63	percent			1.11	percent		
Clay								11.9	percent			10.4	percent			1.68	percent			0.93	percent		
	370	780	5200	—	29000	5.2	13	256			13.62	981			75.46	105.4			32.33	1.6			2.08
Naphthalene	99	170	2100	—	2400	2.1	2.4	17	µg/kg	JD	0.90	69	µg/kg	D	5.31	23	µg/kg		7.06	4.7	µg/kg		6.10
Acenaphthylene	66	66	560	—	1300	1.3	1.3	16	µg/kg	JD	0.85	59	µg/kg	D	4.54	5.8	µg/kg		1.78	2.9	µg/kg	U	3.77
Acenaphthene	16	57	500	—	2000	0.50	0.73	19	µg/kg	JD	1.01	53	µg/kg	D	4.08	3.6	µg/kg		1.10	2.9	µg/kg	U	3.77
Fluorene	23	79	540	—	3600	0.54	1.0	26	µg/kg	D	1.38	160	µg/kg	D	12.31	14	µg/kg		4.29	2.9	µg/kg	U	3.77
Phenanthrene	100	480	1500	—	21000	1.5	5.4	130	µg/kg	D	6.91	290	µg/kg	D	22.31	20	µg/kg		6.13	1.6	µg/kg	J	2.08
Anthracene	220	1200	960	—	13000	0.96	4.4	48	µg/kg	D	2.55	350	µg/kg	D	26.92	39	µg/kg		11.96	2.9	µg/kg	U	3.77
2-Methylnaphthalene	38	64	670	—	1900	0.67	1.4	13	µg/kg	JD	0.69	36	µg/kg	U	2.77	3.3	µg/kg		1.01	2.9	µg/kg	U	3.77
	960	5300	12000	4600	69000	12	17	2402			127.77	18640			1433.85	2940			901.84	41.6			54.03
Fluoranthene	160	1200	1700	11980	30000	1.7	2.5	330	µg/kg	D	17.55	1600	µg/kg	D	123.08	450	µg/kg		138.04	4.4	µg/kg		5.71
Pyrene	1000	1400	2600	—	16000	2.6	3.3	840	µg/kg	D	44.68	*9000*	µg/kg	D	692.31	1200	µg/kg	D	368.10	23	µg/kg		29.87
Benz(a)anthracene	110	270	1300	—	5100	1.3	1.6	150	µg/kg	D	7.98	*1900*	µg/kg	D	146.15	380	µg/kg		116.56	3.7	µg/kg		4.81
Chrysene	110	460	1400	—	21000	1.4	2.8	190	µg/kg	D	10.11	*2100*	µg/kg	D	161.54	390	µg/kg		119.63	3	µg/kg		3.90
Benzo(b)fluoranthene								340	µg/kg	D	18.09	1800	µg/kg	D	138.46	230	µg/kg		70.55	3.6	µg/kg		4.68
Benzo(k)fluoranthene								110	µg/kg	D	5.85	590	µg/kg	D	45.38	79	µg/kg		24.23	2.9	µg/kg	U	3.77
Total Benzofluoranthenes	230	450	3200		9900	3.2	3.6	450			23.94	2390			183.85	309			94.79	3.6			4.68
Benzo(a)pyrene	99	210	1600		3600	1.6	3.0	210	µg/kg	D	11.17	1000	µg/kg	D	76.92	130	µg/kg		39.88	2.1	µg/kg	J	2.73
Indeno(1,2,3-cd)pyrene	34	88	600		4400	0.6	0.69	120	µg/kg	D	6.38	350	µg/kg	D	26.92	40	µg/kg		12.27	2.9	µg/kg	U	3.77
Dibenz(a,h)anthracene	12	33	230		1900	0.23	0.54	34	µg/kg	D	1.81	110	µg/kg	D	8.46	12	µg/kg		3.68	2.9	µg/kg	U	3.77
Benzo(g,h,i)perylene	31	78	670		3200	0.67	0.72	78	µg/kg	D	4.15	190	µg/kg	D	14.62	29	µg/kg		8.90	1.8	µg/kg	J	2.34
1,2-Dichlorobenzene	2.3	2.3	35		110	0.035	0.050	*42*	µg/kg	U	2.23	*72*	µg/kg	U	5.54	5.5	µg/kg	U	1.69	5.7	µg/kg	U	*7.40*
1,3-Dichlorobenzene			170					42	µg/kg	U	2.23	72	µg/kg	U	5.54	5.5	µg/kg	U	1.69	5.7	µg/kg	U	7.40
1,4-Dichlorobenzene	3.1	9	110		120	0.11	0.12	42	µg/kg	U	2.23	72	µg/kg	U	5.54	5.5	µg/kg	U	1.69	5.7	µg/kg	U	7.40
1,2,4-Trichlorobenzene	0.81	1.8	31		64	0.031	0.051	*42*	µg/kg	U	***2.23***	***72***	µg/kg	U	5.54	5.5	µg/kg	U	1.69	5.7	µg/kg	U	*7.40*
Hexachlorobenzene	0.38	2.3	22	168	230	0.022	0.070	*42*	µg/kg	U	**2.23**	72	µg/kg	U	5.54	5.5	µg/kg	U	1.69	5.7	µg/kg	U	*7.40*
Dimethyl Phthalate	53	53	71		1400	0.071	0.16	42	µg/kg	U	2.23	*72*	µg/kg	U	5.54	5.5	µg/kg	U	1.69	5.7	µg/kg	U	7.40
Diethyl Phthalate	61	110	200		1200	0.2	1.2	12	µg/kg	JD	0.64	72	µg/kg	U	5.54	5.5	µg/kg	U	1.69	5.7	µg/kg	U	7.40
Di-n-butyl Phthalate	220	1700	1400		5100	1.4	5.1	83	µg/kg	U	4.41	150	µg/kg	U	11.54	11	µg/kg	U	3.37	12	µg/kg	U	15.58
Butyl Benzyl Phthalate	4.9	64	63		970	0.063	0.9	*72*	µg/kg	D	3.83	*72*	µg/kg	U	5.54	5.5	µg/kg	U	1.69	5.7	µg/kg	U	7.40
Bis(2-ethylhexyl) Phthalate	47	78	1300		8300	1.3	3.1	320	µg/kg	JD	17.02	280	µg/kg	JD	21.54	21	µg/kg	J	6.44	57	µg/kg	U	74.03
Di-n-octyl Phthalate	58	4500	6200		6200	6.2	6.2	42	µg/kg	U	2.23	72	µg/kg	U	5.54	5.5	µg/kg	U	1.69	5.7	µg/kg	U	7.40
Dibenzofuran	15	58	540		1700	0.54	0.70	16	µg/kg	JD	0.85	58	µg/kg	JD	4.46	5.6	µg/kg		1.72	2	µg/kg	J	2.60
Hexachlorobutadiene	3.9	6.2				0.011	0.12	42	µg/kg	U	2.23	72	µg/kg	U	5.54	5.5	µg/kg	U	1.69	5.7	µg/kg	U	*7.40*
N-Nitrosodiphenylamine	11	11	28		130	0.028	0.040	13	µg/kg	JD	0.69	*72*	µg/kg	U	5.54	5.5	µg/kg	U	1.69	5.7	µg/kg	U	7.40
PCB 209	12	65	130	38	3100	6.2	6.2	*311*			**16.54**	*302*			23.23	*540*			*165.64*	12			15.58
Aroclor 1016								8.3	µg/kg	U		7.2	µg/kg	U		5.5	µg/kg	U		5.7	µg/kg	U	
Aroclor 1221								17	µg/kg	U		15	µg/kg	U		11	µg/kg	U		12	µg/kg	U	
Aroclor 1232								8.3	µg/kg	U		7.2	µg/kg	U		5.5	µg/kg	U		5.7	µg/kg	U	
Aroclor 1242								86	µg/kg			90	µg/kg			150	µg/kg			5.7	µg/kg	U	
Aroclor 1248								8.3	µg/kg	U		7.2	µg/kg	U		5.5	µg/kg	U		5.7	µg/kg	U	
Aroclor 1254								130	µg/kg			130	µg/kg			260	µg/kg			5.7	µg/kg	U	
Aroclor 1260								95	µg/kg			82	µg/kg			130	µg/kg			5.7	µg/kg	U	
	SQS (µg/kg)	**CSL (µg/kg)**	**SL**	**BT**	**ML**																		
Phenol	420	1200	420		1200	0.42	1.2	20	µg/kg	JD		220	µg/kg	U		17	µg/kg	U		18	µg/kg	U	
2-Methylphenol	63	63	63		77	0.063	0.072	42	µg/kg	U		*72*	µg/kg	U		5.5	µg/kg	U		5.7	µg/kg	U	
4-Methylphenol	670	670	670		3600	0.67	1.8	42	µg/kg	U		72	µg/kg	U		5.5	µg/kg	U		5.7	µg/kg	U	
2,4-Dimethylphenol	29	29	29		210	0.029	0.072	210	µg/kg	U		***360***	µg/kg	U		28	µg/kg	U		*29*	µg/kg	U	
Pentachlorophenol (PCP)	360	690	400	504	690	0.36	0.69	*420*	µg/kg	U		***720***	µg/kg	U		55	µg/kg	U		57	µg/kg	U	
Benzyl Alcohol	57	73	57		870	0.057	0.073	*83*	µg/kg	U		*150*	µg/kg	U		11	µg/kg	U		12	µg/kg	U	
Benzoic Acid	650	650	650		760	0.65	0.65	***830***	µg/kg	U		***1500***	µg/kg	U		110	µg/kg	U		120	µg/kg	U	
Hexachloroethane			1400		14000			42	µg/kg	U		72	µg/kg	U		5.5	µg/kg	U		5.7	µg/kg	U	

Appendix F
Table F-3 Station SC03

Chemical Name	SQS (ppm OC)	CSL (ppm 0C)	SL	BT	ML	LAET	2AET	Station													
								SC032-ZA 3/10/2010 12:14				SC-0-32 ZB 3/10/2010 12:14				SC-032 ZC 3/10/2010 12:14 (compare to dry wt AET)				SC03 ZD 3/10/2010 12:14 (compare to dry wt AET)			
								Valid Result	Result Unit	Valid Flag	TOC NormConc (ppm OC)	Valid Result	Result Unit	Valid Flag	TOC NormConc (ppm OC)	Valid Result	Result Unit	Valid Flag	TOC NormConc (ppm OC)	Valid Result	Result Unit	Valid Flag	TOC NormConc (ppm OC)
Phenol-d6																							
Nitrobenzene-d5																							
2-Fluorobiphenyl																							
2,4,6-Tribromophenol																							
p-Terphenyl-d14			4 TEQ		10 TEQ Volume		Total TEQ	*7.25496*			Total TEQ	***12.64362***			Total TEQ	2.85216			Total TEQ	0.0087			
					averaged to 4 TEQ)		Total TEQ (1/2U)	*8.60737*			Total TEQ (1/2U)	***13.32912***			Total TEQ (1/2U)	3.768			Total TEQ (1/2U)	*6.70555*			
							Dioxin TEQ (0U)	6.529			Dioxin TEQ (0U)	11.276			Dioxin TEQ (0U)	2.127			Dioxin TEQ (0U)	0.0087			
							Dioxin TEQ (1/2U)	7.344			Dioxin TEQ (1/2U)	11.276			Dioxin TEQ (1/2U)	2.628			Dioxin TEQ (1/2U)	4.432			
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)								1.63	ng/Kg	U		0.563	ng/Kg	JK		1.02	ng/Kg	U		1.17	ng/Kg	U	
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)								1.26	ng/Kg	J		2.39	ng/Kg	J		0.445	ng/Kg	J		5.86	ng/Kg	U	
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)								1.01	ng/Kg	J		1.97	ng/Kg	J		0.366	ng/Kg	JK		5.86	ng/Kg	U	
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)								8.61	ng/Kg			15.7	ng/Kg			3.18	ng/Kg	J		5.86	ng/Kg	U	
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)								5.63	ng/Kg	J		10.9	ng/Kg			2.06	ng/Kg	J		5.86	ng/Kg	U	
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)								303	ng/Kg	J		441	ng/Kg	B		87.9	ng/Kg	B		5.86	ng/Kg	U	
Octachlorodibenzo-p-dioxin (OCDD)								2380	ng/Kg	B		3520	ng/Kg	B		808	ng/Kg	B		29	ng/Kg	B	
							Furan TEQ (0U)	0.72596			Furan TEQ (0U)	1.36762			Furan TEQ (0U)	0.72516			Furan TEQ (0U)	0			
							Furan TEQ (1/2U)	1.26337			Furan TEQ (1/2U)	2.05312			Furan TEQ (1/2U)	1.14			Furan TEQ (1/2U)	2.27355			
2,3,7,8-Tetrachlorodibenzofuran (TCDF)								0.48	ng/Kg	J		0.525	ng/Kg	J		0.242	ng/Kg	J		1.17	ng/Kg	U	
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)								0.319	ng/Kg	JK		0.454	ng/Kg	J		0.22	ng/Kg	J		5.86	ng/Kg	U	
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)								0.442	ng/Kg	JK		0.788	ng/Kg	J		0.449	ng/Kg	J		5.86	ng/Kg	U	
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)								1.99	ng/Kg	J		4.59	ng/Kg	J		2.27	ng/Kg	J		5.86	ng/Kg	U	
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)								0.824	ng/Kg	J		1.38	ng/Kg	J		0.686	ng/Kg	J		5.86	ng/Kg	U	
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)								8.14	ng/Kg	U		6.69	ng/Kg	U		5.1	ng/Kg	U		5.86	ng/Kg	U	
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)								0.55	ng/Kg	J		0.785	ng/Kg	J		0.357	ng/Kg	J		5.86	ng/Kg	U	
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)								17.3	ng/Kg	B		32.3	ng/Kg	B		19.7	ng/Kg	B		5.86	ng/Kg	U	
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)								1.19	ng/Kg	J		2.76	ng/Kg	J		1.36	ng/Kg	J		5.86	ng/Kg	U	
Octachlorodibenzofuran (OCDF)								48.3	ng/Kg	B		130	ng/Kg	B		59.2	ng/Kg	B		11.7	ng/Kg	U	
Tetrachlorodibenzo-p-dioxins (TCDD), Total								1.63	ng/Kg	U		2.43	ng/Kg			0.75	ng/Kg	J		0.267	ng/Kg	J	
Pentachlorodibenzo-p-dioxin (PeCDD), Total								4.59	ng/Kg	J		11.4	ng/Kg			1.21	ng/Kg	J		5.86	ng/Kg	U	
Hexachlorodibenzo-p-dioxins (HxCDD), Total								81	ng/Kg			149	ng/Kg			23.4	ng/Kg			0.926	ng/Kg	J	
Heptachlorodibenzo-p-dioxins (HpCDD), Total								813	ng/Kg			1280	ng/Kg			187	ng/Kg			9.08	ng/Kg		
Tetrachlorodibenzofurans (TCDF), Total								2.35	ng/Kg			9.29	ng/Kg			5.23	ng/Kg			1.17	ng/Kg	U	
Pentachlorodibenzofurans (PeCDF), Total								6.69	ng/Kg	J		12.9	ng/Kg			7.83	ng/Kg			5.86	ng/Kg	U	
Hexachlorodibenzofurans (HxCDF), Total								27.3	ng/Kg			48.4	ng/Kg			25.8	ng/Kg			0.292	ng/Kg	J	
Heptachlorodibenzofurans (HpCDF), Total								66.3	ng/Kg			136	ng/Kg			72.3	ng/Kg			1.28	ng/Kg	J	
2,3,7,8-Tetrachlorodibenzo-p-dioxin-C13																							
1,2,3,7,8-Pentachlorodibenzo-p-dioxin-C13																							
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin-C13																							
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin-C13																							
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin-C13																							
Octachlorodibenzo-p-dioxin-C13																							
2,3,7,8-Tetrachlorodibenzofuran-C13																							
1,2,3,7,8-Pentachlorodibenzofuran-C13																							
2,3,4,7,8-Pentachlorodibenzofuran-C13																							
1,2,3,4,7,8-Hexachlorodibenzofuran-C13																							
1,2,3,6,7,8-Hexachlorodibenzofuran-C13																							
1,2,3,7,8,9-Hexachlorodibenzofuran-C13																							
2,3,4,6,7,8-Hexachlorodibenzofuran-C13																							
1,2,3,4,6,7,8-Heptachlorodibenzofuran-C13																							
1,2,3,4,7,8,9-Heptachlorodibenzofuran-C13																							

Notes:
J - The analyte was detected above the reported quantitation limit, and the reported concentration was an estimated value.
R - The result was rejected and could not be used.
U - The analyte was analyzed for, but was considered not detected at the reporting limit or reported value.
UJ - The analyte was analyzed for, and the associated quantitation limit was an estimated value.

Double border indicates DMMP bioaccumulation trigger

A heavy border with *italicized font* indicates DMMP screening level

A heavy border with ***italicized, bold font*** indicates DMMP maximum level

Appendix F
Table F-4 Station SC04

Chemical Name	SQS (ppm OC)	CSL (ppm 0C)	SL	BT	ML	LAET	2AET	Station SC042ZA 3/10/2010 14:34 (compare to dry wt AET) Result Value	Result Unit	Valid Qual	TOC NormConc (ppm OC)	Station SC042ZB 3/10/2010 14:34 (compare to dry wt AET) Result Value	Result Unit	Valid Qual	TOC NormConc (ppm OC)	Station SC042ZC 3/10/2010 14:34 (compare to dry wt AET) Result Value	Result Unit	Valid Qual	TOC NormConc (ppm OC)	Station SC042 ZD 3/10/2010 14:34 (compare to dry wt AET) Result Value	Result Unit	Valid Qual	TOC NormConc (ppm OC)
Solids, Total								87	percent			89.7	percent			87.6	percent			86.8	percent		
Carbon, Total Organic (TOC)								**0.0865**	percent			**0.054**	percent			**0.047**	percent	J		**0.052**	percent		
Gravel								43.95	percent			54.1	percent			50.4	percent			42.8	percent		
Sand, Very Coarse								8.15	percent			7.44	percent			6.57	percent			5.26	percent		
Sand, Coarse								12.35	percent			9.5	percent			9.47	percent			8.51	percent		
Sand, Medium								24.65	percent			20.7	percent			21.2	percent			25.3	percent		
Sand, Fine								9.27	percent			6.86	percent			11.4	percent			16.1	percent		
Sand, Very Fine								0.985	percent			0.73	percent			1.54	percent			2.17	percent		
Silt								0.565	percent			0.42	percent			0.73	percent			0.65	percent		
Clay								0.7	percent			0.55	percent			0.98	percent			0.82	percent		
	370	780	5200	—	29000	5.2	13	2.9			3.35	2.8			5.19	2.9			6.17	2.9			5.58
Naphthalene	99	170	2100	—	2400	2.1	2.4	2.9	µg/kg	U	3.35	2.8	µg/kg	U	5.19	2.9	µg/kg	U	6.17	2.9	µg/kg	U	5.58
Acenaphthylene	66	66	560	—	1300	1.3	1.3	2.9	µg/kg	U	3.35	2.8	µg/kg	U	5.19	2.9	µg/kg	U	6.17	2.9	µg/kg	U	5.58
Acenaphthene	16	57	500	—	2000	0.50	0.73	2.9	µg/kg	U	3.35	2.8	µg/kg	U	5.19	2.9	µg/kg	U	6.17	2.9	µg/kg	U	5.58
Fluorene	23	79	540	—	3600	0.54	1.0	2.9	µg/kg	U	3.35	2.8	µg/kg	U	5.19	2.9	µg/kg	U	6.17	2.9	µg/kg	U	5.58
Phenanthrene	100	480	1500	—	21000	1.5	5.4	2.9	µg/kg	U	3.35	2.8	µg/kg	U	5.19	2.9	µg/kg	U	6.17	2.9	µg/kg	U	5.58
Anthracene	220	1200	960	—	13000	0.96	4.4	2.9	µg/kg	U	3.35	2.8	µg/kg	U	5.19	2.9	µg/kg	U	6.17	2.9	µg/kg	U	5.58
2-Methylnaphthalene	38	64	670	—	1900	0.67	1.4	2.9	µg/kg	U	3.35	2.8	µg/kg	U	5.19	2.9	µg/kg	U	6.17	2.9	µg/kg	U	5.58
	960	5300	12000	4600	69000	12	17	3.4			3.93	2.8			5.19	2.9			6.17	1.6			3.08
Fluoranthene	160	1200	1700	11980	30000	1.7	2.5	2.9	µg/kg	U	3.35	2.8	µg/kg	U	5.19	2.9	µg/kg	U	6.17	2.9	µg/kg	U	5.58
Pyrene	1000	1400	2600	—	16000	2.6	3.3	2.9	µg/kg	U	3.35	2.8	µg/kg	U	5.19	2.9	µg/kg	U	6.17	1.6	µg/kg	J	3.08
Benz(a)anthracene	110	270	1300	—	5100	1.3	1.6	2.9	µg/kg	U	3.35	2.8	µg/kg	U	5.19	2.9	µg/kg	U	6.17	2.9	µg/kg	U	5.58
Chrysene	110	460	1400	—	21000	1.4	2.8	2.9	µg/kg	U	3.35	2.8	µg/kg	U	5.19	2.9	µg/kg	U	6.17	2.9	µg/kg	U	5.58
Benzo(b)fluoranthene								2.9	µg/kg	U	3.35	2.8	µg/kg	U	5.19	2.9	µg/kg	U	6.17	2.9	µg/kg	U	5.58
Benzo(k)fluoranthene								2.9	µg/kg	U	3.35	2.8	µg/kg	U	5.19	2.9	µg/kg	U	6.17	2.9	µg/kg	U	5.58
Total Benzofluoranthenes	230	450	3200		9900	3.2	3.6	2.9			3.35	2.8			5.19	2.9			6.17	2.9			5.58
Benzo(a)pyrene	99	210	1600		3600	1.6	3.0	2.9	µg/kg	U	3.35	2.8	µg/kg	U	5.19	2.9	µg/kg	U	6.17	2.9	µg/kg	U	5.58
Indeno(1,2,3-cd)pyrene	34	88	600		4400	0.6	0.69	2.9	µg/kg	U	3.35	2.8	µg/kg	U	5.19	2.9	µg/kg	U	6.17	2.9	µg/kg	U	5.58
Dibenz(a,h)anthracene	12	33	230		1900	0.23	0.54	2.9	µg/kg	U	3.35	2.8	µg/kg	U	5.19	2.9	µg/kg	U	6.17	2.9	µg/kg	U	5.58
Benzo(g,h,i)perylene	31	78	670		3200	0.67	0.72	3.4	µg/kg		3.93	2.8	µg/kg	U	5.19	2.9	µg/kg	U	6.17	2.9	µg/kg	U	5.58
1,2-Dichlorobenzene	2.3	2.3	35		110	0.035	0.050	5.7	µg/kg	U	6.59	5.6	µg/kg	U	10.37	5.7	µg/kg	U	12.13	5.8	µg/kg	U	11.15
1,3-Dichlorobenzene			170					5.7	µg/kg	U	6.59	5.6	µg/kg	U	10.37	5.7	µg/kg	U	12.13	5.8	µg/kg	U	11.15
1,4-Dichlorobenzene	3.1	9	110		120	0.11	0.12	5.7	µg/kg	U	6.59	5.6	µg/kg	U	10.37	5.7	µg/kg	U	12.13	5.8	µg/kg	U	11.15
1,2,4-Trichlorobenzene	0.81	1.8	31		64	0.031	0.051	5.7	µg/kg	U	6.59	5.6	µg/kg	U	10.37	5.7	µg/kg	U	12.13	5.8	µg/kg	U	11.15
Hexachlorobenzene	0.38	2.3	22	168	230	0.022	0.070	5.7	µg/kg	U	***6.59***	5.6	µg/kg	U	10.37	5.7	µg/kg	U	12.13	5.8	µg/kg	U	11.15
Dimethyl Phthalate	53	53	71		1400	0.071	0.16	5.7	µg/kg	U	6.59	5.6	µg/kg	U	10.37	5.7	µg/kg	U	12.13	5.8	µg/kg	U	11.15
Diethyl Phthalate	61	110	200		1200	0.2	1.2	5.7	µg/kg	U	6.59	5.6	µg/kg	U	10.37	5.7	µg/kg	U	12.13	5.8	µg/kg	U	11.15
Di-n-butyl Phthalate	220	1700	1400		5100	1.4	5.1	12	µg/kg	U	13.87	12	µg/kg	U	22.22	12	µg/kg	U	25.53	12	µg/kg	U	23.08
Butyl Benzyl Phthalate	4.9	64	63		970	0.063	0.9	5.7	µg/kg	U	6.59	5.6	µg/kg	U	10.37	5.7	µg/kg	U	12.13	5.8	µg/kg	U	11.15
Bis(2-ethylhexyl) Phthalate	47	78	1300		8300	1.3	3.1	57	µg/kg	U	65.90	56	µg/kg	U	103.70	57	µg/kg	U	121.28	58	µg/kg	U	111.54
Di-n-octyl Phthalate	58	4500	6200		6200	6.2	6.2	5.7	µg/kg	U	6.59	5.6	µg/kg	U	10.37	5.7	µg/kg	U	12.13	5.8	µg/kg	U	11.15
Dibenzofuran	15	58	540		1700	0.54	0.70	5.7	µg/kg	U	6.59	5.6	µg/kg	U	10.37	5.7	µg/kg	U	12.13	5.8	µg/kg	U	11.15
Hexachlorobutadiene	3.9	6.2				0.011	0.12	5.7	µg/kg	U	***6.59***	5.6	µg/kg	U	10.37	5.7	µg/kg	U	12.13	5.8	µg/kg	U	11.15
N-Nitrosodiphenylamine	11	11	28		130	0.028	0.040	5.7	µg/kg	U	6.59	5.6	µg/kg	U	10.37	5.7	µg/kg	U	12.13	5.8	µg/kg	U	11.15
PCB 209	12	65	130	38	3100	6.2	6.2	12			13.87	12			22.22	12			25.53	12			23.08
Aroclor 1016								5.8	µg/kg	U		5.6	µg/kg	U		5.8	µg/kg	U		5.8	µg/kg	U	
Aroclor 1221								12	µg/kg	U		12	µg/kg	U		12	µg/kg	U		12	µg/kg	U	
Aroclor 1232								5.8	µg/kg	U		5.6	µg/kg	U		5.8	µg/kg	U		5.8	µg/kg	U	
Aroclor 1242								5.8	µg/kg	U		5.6	µg/kg	U		5.8	µg/kg	U		5.8	µg/kg	U	
Aroclor 1248								5.8	µg/kg	U		5.6	µg/kg	U		5.8	µg/kg	U		5.8	µg/kg	U	
Aroclor 1254								5.8	µg/kg	U		5.6	µg/kg	U		5.8	µg/kg	U		5.8	µg/kg	U	
Aroclor 1260								5.8	µg/kg	U		5.6	µg/kg	U		5.8	µg/kg	U		5.8	µg/kg	U	
	SQS (µg/kg)	**CSL (µg/kg)**	**SL**	**BT**	**ML**																		
Phenol	420	1200	420		1200	0.42	1.2	18	µg/kg	U		17	µg/kg	U		18	µg/kg	U		18	µg/kg	U	
2-Methylphenol	63	63	63		77	0.063	0.072	5.7	µg/kg	U		5.6	µg/kg	U		5.7	µg/kg	U		5.8	µg/kg	U	
4-Methylphenol	670	670	670		3600	0.67	1.8	5.7	µg/kg	U		5.6	µg/kg	U		5.7	µg/kg	U		5.8	µg/kg	U	
2,4-Dimethylphenol	29	29	29		210	0.029	0.072	29	µg/kg	U		28	µg/kg	U		29	µg/kg	U		29	µg/kg	U	
Pentachlorophenol (PCP)	360	690	400	504	690	0.36	0.69	57	µg/kg	U		56	µg/kg	U		57	µg/kg	U		58	µg/kg	U	
Benzyl Alcohol	57	73	57		870	0.057	0.073	12	µg/kg	U		12	µg/kg	U		12	µg/kg	U		12	µg/kg	U	
Benzoic Acid	650	650	650		760	0.65	0.65	120	µg/kg	U		120	µg/kg	U		120	µg/kg	U		120	µg/kg	U	
Hexachloroethane			1400		14000			5.7	µg/kg	U		5.6	µg/kg	U		5.7	µg/kg	U		5.8	µg/kg	U	

Appendix F
Table F-4 Station SC04

Chemical Name	SQS (ppm OC)	CSL (ppm 0C)	SL	BT	ML	LAET	2AET	Station SC042ZA 3/10/2010 14:34 (compare to dry wt AET) Result Value	Result Unit	Valid Qual	TOC NormConc (ppm OC)	Station SC042ZB 3/10/2010 14:34 (compare to dry wt AET) Result Value	Result Unit	Valid Qual	TOC NormConc (ppm OC)	Station SC042ZC 3/10/2010 14:34 (compare to dry wt AET) Result Value	Result Unit	Valid Qual	TOC NormConc (ppm OC)	Station SC042 ZD 3/10/2010 14:34 (compare to dry wt AET) Result Value	Result Unit	Valid Qual	TOC NormConc (ppm OC)
Phenol-d6																							
Nitrobenzene-d5																							
2-Fluorobiphenyl																							
2,4,6-Tribromophenol																							
p-Terphenyl-d14			4 TEQ		10 TEQ Volume		Total TEQ	0			Total TEQ	0.0116			Total TEQ	0			Total TEQ	0			
					averaged to 4 TEQ)		Total TEQ (1/2U)	*7.622935*			Total TEQ (1/2U)	*6.38608*			Total TEQ (1/2U)	*6.40248*			Total TEQ (1/2U)	*6.21039*			
							Dioxin TEQ (0U)	0			Dioxin TEQ (0U)	0.0116			Dioxin TEQ (0U)	0			Dioxin TEQ (0U)	0			
							Dioxin TEQ (1/2U)	4.103285			Dioxin TEQ (1/2U)	4.21328			Dioxin TEQ (1/2U)	4.22968			Dioxin TEQ (1/2U)	4.103285			
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)								1.09	ng/Kg	U		1.12	ng/Kg	U		1.12	ng/Kg	U		1.09	ng/Kg	U	
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)								5.43	ng/Kg	U		5.6	ng/Kg	U		5.6	ng/Kg	U		5.43	ng/Kg	U	
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)								5.43	ng/Kg	U		5.6	ng/Kg	U		5.6	ng/Kg	U		5.43	ng/Kg	U	
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)								5.43	ng/Kg	U		5.6	ng/Kg	U		5.6	ng/Kg	U		5.43	ng/Kg	U	
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)								5.43	ng/Kg	U		5.6	ng/Kg	U		5.6	ng/Kg	U		5.43	ng/Kg	U	
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)								5.43	ng/Kg	U		1.16	ng/Kg	BJ		5.6	ng/Kg	U		5.43	ng/Kg	U	
Octachlorodibenzo-p-dioxin (OCDD)								10.9	ng/Kg	U		11.2	ng/Kg	U		11.2	ng/Kg	U		10.9	ng/Kg	U	
							Furan TEQ (0U)	0			Furan TEQ (0U)	0			Furan TEQ (0U)	0			Furan TEQ (0U)	0			
							Furan TEQ (1/2U)	3.51965			Furan TEQ (1/2U)	2.1728			Furan TEQ (1/2U)	2.1728			Furan TEQ (1/2U)	2.1071			
2,3,7,8-Tetrachlorodibenzofuran (TCDF)								11.2	ng/Kg	U		1.12	ng/Kg	U		1.12	ng/Kg	U		1.09	ng/Kg	U	
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)								11.2	ng/Kg	U		5.6	ng/Kg	U		5.6	ng/Kg	U		5.43	ng/Kg	U	
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)								10.9	ng/Kg	U		5.6	ng/Kg	U		5.6	ng/Kg	U		5.43	ng/Kg	U	
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)								5.43	ng/Kg	U		5.6	ng/Kg	U		5.6	ng/Kg	U		5.43	ng/Kg	U	
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)								5.43	ng/Kg	U		5.6	ng/Kg	U		5.6	ng/Kg	U		5.43	ng/Kg	U	
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)								5.43	ng/Kg	U		5.6	ng/Kg	U		5.6	ng/Kg	U		5.43	ng/Kg	U	
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)								5.43	ng/Kg	U		5.6	ng/Kg	U		5.6	ng/Kg	U		5.43	ng/Kg	U	
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)								5.43	ng/Kg	U		5.6	ng/Kg	U		5.6	ng/Kg	U		5.43	ng/Kg	U	
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)								5.43	ng/Kg	U		5.6	ng/Kg	U		5.6	ng/Kg	U		5.43	ng/Kg	U	
Octachlorodibenzofuran (OCDF)								10.9	ng/Kg	U		11.2	ng/Kg	U		11.2	ng/Kg	U		10.9	ng/Kg	U	
Tetrachlorodibenzo-p-dioxins (TCDD), Total								1.09	ng/Kg	U		1.12	ng/Kg	U		1.12	ng/Kg	U		1.09	ng/Kg	U	
Pentachlorodibenzo-p-dioxin (PeCDD), Total								5.43	ng/Kg	U		5.6	ng/Kg	U		5.6	ng/Kg	U		5.43	ng/Kg	U	
Hexachlorodibenzo-p-dioxins (HxCDD), Total								5.43	ng/Kg	U		5.6	ng/Kg	U		5.6	ng/Kg	U		5.43	ng/Kg	U	
Heptachlorodibenzo-p-dioxins (HpCDD), Total								0.954	ng/Kg	J		3.56	ng/Kg	J		0.485	ng/Kg	J		0.691	ng/Kg	J	
Tetrachlorodibenzofurans (TCDF), Total								1.09	ng/Kg	U		1.12	ng/Kg	U		1.12	ng/Kg	U		1.09	ng/Kg	U	
Pentachlorodibenzofurans (PeCDF), Total								5.43	ng/Kg	U		5.6	ng/Kg	U		5.6	ng/Kg	U		5.43	ng/Kg	U	
Hexachlorodibenzofurans (HxCDF), Total								5.43	ng/Kg	U		5.6	ng/Kg	U		3.21	ng/Kg	J		5.43	ng/Kg	U	
Heptachlorodibenzofurans (HpCDF), Total								5.43	ng/Kg	U		0.321	ng/Kg	J		5.6	ng/Kg	U		5.43	ng/Kg	U	
2,3,7,8-Tetrachlorodibenzo-p-dioxin-C13																							
1,2,3,7,8-Pentachlorodibenzo-p-dioxin-C13																							
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin-C13																							
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin-C13																							
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin-C13																							
Octachlorodibenzo-p-dioxin-C13																							
2,3,7,8-Tetrachlorodibenzofuran-C13																							
1,2,3,7,8-Pentachlorodibenzofuran-C13																							
2,3,4,7,8-Pentachlorodibenzofuran-C13																							
1,2,3,4,7,8-Hexachlorodibenzofuran-C13																							
1,2,3,6,7,8-Hexachlorodibenzofuran-C13																							
1,2,3,7,8,9-Hexachlorodibenzofuran-C13																							
2,3,4,6,7,8-Hexachlorodibenzofuran-C13																							
1,2,3,4,6,7,8-Heptachlorodibenzofuran-C13																							
1,2,3,4,7,8,9-Heptachlorodibenzofuran-C13																							

Notes:
J - The analyte was detected above the reported quantitation limit, and the reported concentration was an estimated value.
U - The analyte was analyzed for, but was considered not detected at the reporting limit or reported value.

Double border indicates DMMP bioaccumulation trigger

A heavy border with *italicized font* indicates DMMP screening level

A heavy border with ***italicized, bold font*** indicates DMMP maximum level

Appendix F
Table F-5 Station SC043

Chemical Name	SQS (ppm OC)	CSL (ppm 0C)	SL	BT	ML	LAET	2AET	Station SC043 ZA 3/10/2010 13:00 Result Value	Result Unit	Valid Qual	TOC NormConc (ppm OC)
Solids, Total								75.5	percent		
Carbon, Total Organic (TOC)								0.814	percent		
Gravel								19.2	percent		
Sand, Very Coarse								11.6	percent		
Sand, Coarse								12.6	percent		
Sand, Medium								13.4	percent		
Sand, Fine								6.82	percent		
Sand, Very Fine								3.29	percent		
Silt								21.4	percent		
Clay								8.69	percent		
	370	780	5200	—	29000	5.2	13	47.4			5.82
Naphthalene	99	170	2100	—	2400	2.1	2.4	4.2	µg/kg		0.52
Acenaphthylene	66	66	560	—	1300	1.3	1.3	4.8	µg/kg		0.59
Acenaphthene	16	57	500	—	2000	0.50	0.73	2.5	µg/kg	J	0.31
Fluorene	23	79	540	—	3600	0.54	1.0	3.6	µg/kg		0.44
Phenanthrene	100	480	1500	—	21000	1.5	5.4	23	µg/kg		2.83
Anthracene	220	1200	960	—	13000	0.96	4.4	9.3	µg/kg		1.14
2-Methylnaphthalene	38	64	670	—	1900	0.67	1.4	4.1	µg/kg		0.50
	960	5300	12000	4600	69000	12	17	295.4			36.29
Fluoranthene	160	1200	1700	11980	30000	1.7	2.5	42	µg/kg		5.16
Pyrene	1000	1400	2600	—	16000	2.6	3.3	58	µg/kg		7.13
Benz(a)anthracene	110	270	1300	—	5100	1.3	1.6	21	µg/kg		2.58
Chrysene	110	460	1400	—	21000	1.4	2.8	30	µg/kg		3.69
Benzo(b)fluoranthene								56	µg/kg		6.88
Benzo(k)fluoranthene								19	µg/kg		2.33
	230	450	3200		9900	3.2	3.6	75			9.21
Benzo(a)pyrene	99	210	1600		3600	1.6	3.0	31	µg/kg		3.81
Indeno(1,2,3-cd)pyrene	34	88	600		4400	0.6	0.69	22	µg/kg		2.70
Dibenz(a,h)anthracene	12	33	230		1900	0.23	0.54	5.4	µg/kg		0.66
Benzo(g,h,i)perylene	31	78	670		3200	0.67	0.72	11	µg/kg		1.35
1,2-Dichlorobenzene	2.3	2.3	35		110	0.035	0.050	6.6	µg/kg	U	0.81
1,3-Dichlorobenzene			170					6.6	µg/kg	U	0.81
1,4-Dichlorobenzene	3.1	9	110		120	0.11	0.12	6.6	µg/kg	U	0.81
1,2,4-Trichlorobenzene	0.81	1.8	31		64	0.031	0.051	6.6	µg/kg	U	**0.81**
Hexachlorobenzene	0.38	2.3	22	168	230	0.022	0.070	6.6	µg/kg	U	**0.81**
Dimethyl Phthalate	53	53	71		1400	0.071	0.16	6.6	µg/kg	U	0.81
Diethyl Phthalate	61	110	200		1200	0.2	1.2	6.6	µg/kg	U	0.81
Di-n-butyl Phthalate	220	1700	1400		5100	1.4	5.1	14	µg/kg	U	1.72
Butyl Benzyl Phthalate	4.9	64	63		970	0.063	0.9	13	µg/kg		1.60
Bis(2-ethylhexyl) Phthalate	47	78	1300		8300	1.3	3.1	41	µg/kg	J	5.04
Di-n-octyl Phthalate	58	4500	6200		6200	6.2	6.2	6.6	µg/kg	U	0.81
Dibenzofuran	15	58	540		1700	0.54	0.70	3	µg/kg	J	0.37
Hexachlorobutadiene	3.9	6.2				0.011	0.12	6.6	µg/kg	U	0.81
N-Nitrosodiphenylamine	11	11	28		130	0.028	0.040	6.6	µg/kg	U	0.81
PCB 209	12	65	130	38	3100	6.2	6.2	*203*			**24.94**
Aroclor 1016								6.6	µg/kg	U	
Aroclor 1221								14	µg/kg	U	
Aroclor 1232								6.6	µg/kg	U	
Aroclor 1242								44	µg/kg		
Aroclor 1248								6.6	µg/kg	U	
Aroclor 1254								97	µg/kg		
Aroclor 1260								62	µg/kg		
	SQS (µg/kg)	**CSL (µg/kg)**	**SL**	**BT**	**ML**						
Phenol	420	1200	420		1200	0.42	1.2	20	µg/kg	U	
2-Methylphenol	63	63	63		77	0.063	0.072	6.6	µg/kg	U	
4-Methylphenol	670	670	670		3600	0.67	1.8	6.6	µg/kg	U	
2,4-Dimethylphenol	29	29	29		210	0.029	0.072	33	µg/kg	U	
Pentachlorophenol (PCP)	360	690	400	504	690	0.36	0.69	66	µg/kg	U	
Benzyl Alcohol	57	73	57		870	0.057	0.073	14	µg/kg	U	
Benzoic Acid	650	650	650		760	0.65	0.65	140	µg/kg	U	
Hexachloroethane			1400		14000			6.6	µg/kg	U	
Phenol-d6											
Nitrobenzene-d5											
2-Fluorobiphenyl											
2,4,6-Tribromophenol											
p-Terphenyl-d14			4 TEQ Total		10 TEQ Volume Weighted		Total TEQ				
							Total TEQ (1/2U)				
							Dioxin TEQ (0U)				
							Dioxin TEQ (1/2U)				
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)								0.79	ng/Kg	J	
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)								0.902	ng/Kg		
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)								0.93	ng/Kg	J	
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)								12.2	ng/Kg		
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)								6.41	ng/Kg	J	
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)								389	ng/Kg		
Octachlorodibenzo-p-dioxin (OCDD)								5870	ng/Kg	J	
							Furan TEQ (0U)	26.204126			
							Furan TEQ (1/2U)	26.54916			
2,3,7,8-Tetrachlorodibenzofuran (TCDF)								0.795	ng/Kg	J	
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)								1.54	ng/Kg	J	
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)								6.72	ng/Kg	J	
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)								48.2	ng/Kg		
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)								7.48	ng/Kg		
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)								6.77	ng/Kg	U	
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)								7.62	ng/Kg		
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)								80.1	ng/Kg		
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)								9.78	ng/Kg		
Octachlorodibenzofuran (OCDF)								177	ng/Kg		
Tetrachlorodibenzo-p-dioxins (TCDD), Total								2.42	ng/Kg		
Pentachlorodibenzo-p-dioxin (PeCDD), Total								1.72	ng/Kg	J	
Hexachlorodibenzo-p-dioxins (HxCDD), Total								68.6	ng/Kg		
Heptachlorodibenzo-p-dioxins (HpCDD), Total								897	ng/Kg		

Appendix F
Table F-5 Station SC043

Chemical Name	SQS (ppm OC)	CSL (ppm 0C)	SL	BT	ML	LAET	2AET	Station SC043 ZA 3/10/2010 13:00 Result Value	Result Unit	Valid Qual	TOC NormConc (ppm OC)
Tetrachlorodibenzofurans (TCDF), Total								11.4	ng/Kg		
Pentachlorodibenzofurans (PeCDF), Total								65.3	ng/Kg		
Hexachlorodibenzofurans (HxCDF), Total								210	ng/Kg		
Heptachlorodibenzofurans (HpCDF), Total								311	ng/Kg		
2,3,7,8-Tetrachlorodibenzo-p-dioxin-C13											
1,2,3,7,8-Pentachlorodibenzo-p-dioxin-C13											
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin-C13											
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin-C13											
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin-C13											
Octachlorodibenzo-p-dioxin-C13											
2,3,7,8-Tetrachlorodibenzofuran-C13											
1,2,3,7,8-Pentachlorodibenzofuran-C13											
2,3,4,7,8-Pentachlorodibenzofuran-C13											
1,2,3,4,7,8-Hexachlorodibenzofuran-C13											
1,2,3,6,7,8-Hexachlorodibenzofuran-C13											
1,2,3,7,8,9-Hexachlorodibenzofuran-C13											
2,3,4,6,7,8-Hexachlorodibenzofuran-C13											
1,2,3,4,6,7,8-Heptachlorodibenzofuran-C13											
1,2,3,4,7,8,9-Heptachlorodibenzofuran-C13											

Notes:
J - The analyte was detected above the reported quantitation limit, and the reported concentration was an estimated value.
U - The analyte was analyzed for, but was considered not detected at the reporting limit or reported value.

Double border indicates DMMP bioaccumulation trigger

A heavy border with *italicized font* indicates DMMP screening level

A heavy border with ***italicized, bold font*** indicates DMMP maximum level

Appendix F
Table F-6 Station SC05

Chemical Name	SQS (ppm OC)	CSL (ppm 0C)	SL	BT	ML	LAET	2AET	Station SC05 ZA 3/10/2010 12:14 Result Value	Result Unit	Valid Qual	TOC NormConc (ppm OC)
Solids, Total								61.8	percent		
Carbon, Total Organic (TOC)								2.04	percent		
Gravel								0.56	percent		
Sand, Very Coarse								1.39	percent		
Sand, Coarse								2.47	percent		
Sand, Medium								3.2	percent		
Sand, Fine								3.55	percent		
Sand, Very Fine								14.3	percent		
Silt								54.5	percent		
Clay								13.2	percent		
	370	780	5200	—	29000	5.2	13	249			12.21
Naphthalene	99	170	2100	—	2400	2.1	2.4	16	µg/kg		0.78
Acenaphthylene	66	66	560	—	1300	1.3	1.3	18	µg/kg		0.88
Acenaphthene	16	57	500	—	2000	0.50	0.73	17	µg/kg		0.83
Fluorene	23	79	540	—	3600	0.54	1.0	24	µg/kg		1.18
Phenanthrene	100	480	1500	—	21000	1.5	5.4	130	µg/kg		6.37
Anthracene	220	1200	960	—	13000	0.96	4.4	44	µg/kg		2.16
2-Methylnaphthalene	38	64	670	—	1900	0.67	1.4	12	µg/kg		0.59
	960	5300	12000	4600	69000	12	17	2629			128.87
Fluoranthene	160	1200	1700	11980	30000	1.7	2.5	450	µg/kg		22.06
Pyrene	1000	1400	2600	—	16000	2.6	3.3	860	µg/kg		42.16
Benz(a)anthracene	110	270	1300	—	5100	1.3	1.6	190	µg/kg		9.31
Chrysene	110	460	1400	—	21000	1.4	2.8	210	µg/kg		10.29
Benzo(b)fluoranthene								350	µg/kg		17.16
Benzo(k)fluoranthene								120	µg/kg		5.88
	230	450	3200		9900	3.2	3.6	470			23.04
Benzo(a)pyrene	99	210	1600		3600	1.6	3.0	220	µg/kg		10.78
Indeno(1,2,3-cd)pyrene	34	88	600		4400	0.6	0.69	120	µg/kg		5.88
Dibenz(a,h)anthracene	12	33	230		1900	0.23	0.54	35	µg/kg		1.72
Benzo(g,h,i)perylene	31	78	670		3200	0.67	0.72	74	µg/kg		3.63
1,2-Dichlorobenzene	2.3	2.3	35		110	0.035	0.050	*41*	µg/kg	U	2.01
1,3-Dichlorobenzene			170					41	µg/kg	U	2.01
1,4-Dichlorobenzene	3.1	9	110		120	0.11	0.12	41	µg/kg	U	2.01
1,2,4-Trichlorobenzene	0.81	1.8	31		64	0.031	0.051	*41*	µg/kg	U	***2.01***
Hexachlorobenzene	0.38	2.3	22	168	230	0.022	0.070	*41*	µg/kg	U	**2.01**
Dimethyl Phthalate	53	53	71		1400	0.071	0.16	41	µg/kg	U	2.01
Diethyl Phthalate	61	110	200		1200	0.2	1.2	41	µg/kg	U	2.01
Di-n-butyl Phthalate	220	1700	1400		5100	1.4	5.1	81	µg/kg	U	3.97
Butyl Benzyl Phthalate	4.9	64	63		970	0.063	0.9	*66*	µg/kg		3.24
Bis(2-ethylhexyl) Phthalate	47	78	1300		8300	1.3	3.1	230	µg/kg		11.27
Di-n-octyl Phthalate	58	4500	6200		6200	6.2	6.2	41	µg/kg	U	2.01
Dibenzofuran	15	58	540		1700	0.54	0.70	14	µg/kg		0.69
Hexachlorobutadiene	3.9	6.2				0.011	0.12	41	µg/kg	U	2.01
N-Nitrosodiphenylamine	11	11	28		130	0.028	0.040	9.7	µg/kg		0.48
PCB 209	12	65	130	38	3100	6.2	6.2	*282*			**13.82**
Aroclor 1016								8.1	µg/kg	U	
Aroclor 1221								17	µg/kg	U	
Aroclor 1232								8.1	µg/kg	U	
Aroclor 1242								87	µg/kg		
Aroclor 1248								8.1	µg/kg	U	
Aroclor 1254								120	µg/kg		
Aroclor 1260								75	µg/kg		
	SQS (µg/kg)	**CSL (µg/kg)**	**SL**	**BT**	**ML**						
Phenol	420	1200	420		1200	0.42	1.2	16	µg/kg		
2-Methylphenol	63	63	63		77	0.063	0.072	41	µg/kg	U	
4-Methylphenol	670	670	670		3600	0.67	1.8	41	µg/kg	U	
2,4-Dimethylphenol	29	29	29		210	0.029	0.072	*210*	µg/kg	U	
Pentachlorophenol (PCP)	360	690	400	504	690	0.36	0.69	*410*	µg/kg	U	
Benzyl Alcohol	57	73	57		870	0.057	0.073	*81*	µg/kg	U	
Benzoic Acid	650	650	650		760	0.65	0.65	***810***	µg/kg	U	
Hexachloroethane			1400		14000			41	µg/kg	U	
Phenol-d6											
Nitrobenzene-d5											
2-Fluorobiphenyl											
2,4,6-Tribromophenol											
p-Terphenyl-d14			4 TEQ		10 TEQ Volume averaged to 4 TEQ)		Total TEQ	***18.43595***			
							Total TEQ (1/2U)	***19.09745***			
							Dioxin TEQ (0U)	17.094			
							Dioxin TEQ (1/2U)	17.094			
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)								0.645	ng/Kg	J	
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)								1.87	ng/Kg	J	
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)								1.89	ng/Kg	J	
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)								17.2	ng/Kg		
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)								12.7	ng/Kg		
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)								885	ng/Kg	J	
Octachlorodibenzo-p-dioxin (OCDD)								8500	ng/Kg	J	
							Furan TEQ (0U)	1.34195			
							Furan TEQ (1/2U)	2.00345			
2,3,7,8-Tetrachlorodibenzofuran (TCDF)								0.705	ng/Kg	J	
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)								0.535	ng/Kg	J	
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)								0.979	ng/Kg	J	
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)								3.56	ng/Kg	J	
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)								1.18	ng/Kg	J	
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)								7.56	ng/Kg	U	
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)								0.881	ng/Kg	J	
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)								34.1	ng/Kg		
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)								2.71	ng/Kg	J	
Octachlorodibenzofuran (OCDF)								105	ng/Kg		
Tetrachlorodibenzo-p-dioxins (TCDD), Total								1.96	ng/Kg		
Pentachlorodibenzo-p-dioxin (PeCDD), Total								12	ng/Kg		
Hexachlorodibenzo-p-dioxins (HxCDD), Total								271	ng/Kg		
Heptachlorodibenzo-p-dioxins (HpCDD), Total								4050	ng/Kg		
Tetrachlorodibenzofurans (TCDF), Total								11	ng/Kg		
Pentachlorodibenzofurans (PeCDF), Total								16.4	ng/Kg		
Hexachlorodibenzofurans (HxCDF), Total								23.7	ng/Kg		
Heptachlorodibenzofurans (HpCDF), Total								156	ng/Kg		
2,3,7,8-Tetrachlorodibenzo-p-dioxin-C13											
1,2,3,7,8-Pentachlorodibenzo-p-dioxin-C13											

Appendix F
Table F-6 Station SC05

Chemical Name	SQS (ppm OC)	CSL (ppm 0C)	SL	BT	ML	LAET	2AET	Station SC05 ZA 3/10/2010 12:14 Result Value	Result Unit	Valid Qual	TOC NormConc (ppm OC)
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin-C13											
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin-C13											
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin-C13											
Octachlorodibenzo-p-dioxin-C13											
2,3,7,8-Tetrachlorodibenzofuran-C13											
1,2,3,7,8-Pentachlorodibenzofuran-C13											
2,3,4,7,8-Pentachlorodibenzofuran-C13											
1,2,3,4,7,8-Hexachlorodibenzofuran-C13											
1,2,3,6,7,8-Hexachlorodibenzofuran-C13											
1,2,3,7,8,9-Hexachlorodibenzofuran-C13											
2,3,4,6,7,8-Hexachlorodibenzofuran-C13											
1,2,3,4,6,7,8-Heptachlorodibenzofuran-C13											
1,2,3,4,7,8,9-Heptachlorodibenzofuran-C13											

Notes:
J - The analyte was detected above the reported quantitation limit, and the reported concentration was an estimated value.
U - The analyte was analyzed for, but was considered not detected at the reporting limit or reported value.

Double border indicates DMMP bioaccumulation trigger

A heavy border with *italicized font* indicates DMMP screening level

A heavy border with ***italicized, bold font*** indicates DMMP maximum level

Appendix G

Subsurface Sediment Chemical Data Package

(Note: This appendix is provided on DVD)

Appendix H

Subsurface Sediment Validation Report

Data Validation Report

Port of Seattle Terminal 115
Post-Dredge Subsurface Sediment Characterization
January 2010 Sampling

Prepared for:

Science and Engineering for the Environment, LLC.
4401 Latona Ave NE
Seattle, WA 98105

Prepared by:

Pyron Environmental, Inc.
3530 32nd Way NW
Olympia, WA 98502

May 5, 2010

ACRONYMS

%D	percent difference
%D_f	percent drift
%R	percent recovery
%RSD	percent relative standard deviation
CDD	chlorinated dibenzo-p-dioxin
CDF	chlorinated dibenzofuran
CF	calibration factor
CLP	U.S. EPA Contract Laboratory Program
COC	chain-of-custody
DFTPP	decafluorotriphenylphosphine
ECD	electron capture detector
EMPC	estimated maximum possible concentration
EPA	U.S. Environmental Protection Agency
GC/MS	gas chromatograph/mass spectrometer
HRGC	high-resolution gas chromatograph
HRMS	high-resolution mass spectrometer
ICAL	initial calibration
ICB	initial calibration blank
IPR	initial precision and recovery
ISC	isomer specificity check
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
mg/kg	milligram per kilogram
µg/kg	microgram per kilogram
MDL	method detection limit
MS	matrix spike
MSD	matrix spike duplicate
m/z	mass-to-charge ratio
ng/kg	nanogram per kilogram
NFGs	CLP National Functional Guidelines for Data Review (EPA 2008 – Organics, EPA 2005 - Dioxins and Furans)
OPR	ongoing precision and recovery
PCBs	polychlorinated biphenyls

PCDD	polychlorinated dibenzo-p-dioxin
PCDF	polychlorinated dibenzofuran
PEM	performance evaluation mixture
QAPP	quality assurance project plan
QA/QC	quality assurance/quality control
RF	response factor
RL	reporting limit
RPD	relative percent difference
SDG	sample delivery group
SICP	selected ion current profile
S/N	signal-to-noise ratio
SVOCs	semi-volatile organic compounds
WDM	window defining mixture

INTRODUCTION

This report presents and discusses findings of the data validation performed on analytical data for samples collected during January 2010 for the referenced project. The laboratory report validated herein was submitted by Columbia Analytical Services, Inc. in one sample delivery group (SDG) – K1000845.

A level IV data validation was performed. The validation followed the procedures specified in USEPA CLP National Functional Guidelines ([NFGs], EPA 2008 – Organics, EPA 2005 – Chlorinated Dioxin/Furans), with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with those specified in the quality assurance project plans ([QAPPs], Anchor, June 2009) and the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the respective analytical methods.

Validation findings are discussed for each QC parameter pertinent to each type of analyses evaluated. Qualified data with applied data qualifiers are summarized in the **Summary** section at the end of this report. As part of the level IV validation, 10 percent of the initial calibrations, calibration verifications, laboratory QC analyses, and sample results were verified via re-calculation checks.

Samples and the associated analyses validated herein are summarized as follows:

Field Sample ID	Laboratory Sample ID	Sampling Date	Matrix	Analysis			
				SVOCs	PCBs	Dioxin/ Furans	TOC Grain Size
T115-SC-01-100127-ZA	K1000845-001	01/27/2010	Sediment	X	X	X	X
T115-SC-01-100127-ZB	K1000845-002	01/27/2010	Sediment	X	X	X	X
T115-SC-01-100127-ZC	K1000845-003	01/27/2010	Sediment	X	X	X	X
T115-SC-01-100127-ZD	K1000845-004	01/27/2010	Sediment	X	X	X	X
T115-SC-02-100127-ZA	K1000845-016	01/27/2010	Sediment	X	X	X	X
T115-SC-02-100127-ZB	K1000845-017	01/27/2010	Sediment	X	X	X	X
T115-SC-02-100127-ZC	K1000845-018	01/27/2010	Sediment	X	X	X	X
T115-SC-02-100127-ZD	K1000845-019	01/27/2010	Sediment	X	X	X	X

Notes:
X - The analysis was requested and performed on the sample
SVOCs – Semi-volatile organic compounds, analyte list specified in the QAPP
PCBs – Polychlorinated biphenyls (Aroclors only)
Dioxins/Furans – Polychlorinated dioxins & furans
TOC – Total organic carbon

Analytical methods in respect to analytical parameters validated herein and the laboratory performing the analyses are summarized below:

Parameter	Analytical Method	Laboratory
TOC	Plumb, 1981	Columbia Analytical Services, Inc. (CAS), Kelso, Washington
Grain Size	PSEP Protocols	
PCB Aroclors	SW846 Method 8082	
SVOCs	SW846 Method 8270C	
Polychlorinated Dioxins & Furans	EPA Method 1613B	Columbia Analytical Services, Inc. (CAS), Houston, Texas

Notes:

1. SW846 Methods - *USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,* SW-846, Third Edition, December 1996 and Updates.
2. *USEPA Method 1613 Tetra- Through Octa-Chlorinated Dioxins and Furans by Isotope Dilution HRGC/HRMS,* October 1994.
3. PSEP Protocols - *PSEP Recommended Protocols for Measuring Conventional Sediment Variables in Puget Sound,* Puget Sound Water Quality Authority, March 1986.
4. Plumb 1981 - *Procedures for Handling and Chemical Analysis of Sediment and Water Samples.* Technical Report, EPA/CE-B1-1. U.S. Army Corps of Engineers. Plumb, R.H. 1981.

DATA VALIDATION FINDINGS

1. Semi-volatile Organic Compounds (SVOCs) by GC/MS (SW846 Method 8270C)

1.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. All samples were extracted and analyzed within the required holding times.

1.2 GC/MS Instrument Performance Check

DFTPP tuning was performed within each 12-hour interval. All required ion abundance ratios met the method requirements.

1.3 Initial Calibration

The NFGs criteria require that the average response factor (RF) be ≥0.05 for all analytes and surrogate compounds.

The method linearity criteria require that (1) if linear average RFs is chosen as the quantitation option, the %RSD of RFs be ≤15% for the analyte, (2) if least-square linear regression is chosen for quantitation, the correlation coefficient (r) be ≥0.99, and (3) if six-point non-linear (quadratic) curve is chosen for quantitation, the coefficient of determination (r^2) be ≥0.99.

1.4 Calibration Verification

The NFGs criteria require that (1) continuing calibrations be analyzed at the beginning of each 12-hour analysis period prior to the analysis of method blank and samples, (2) the percent difference (%D) be within ±20%, and (3) the RF be ≥0.05 for all analytes and surrogate compounds.

Calibration verifications were performed at the required frequency, and all %D values met the method criterion or the outliers had no effects on data quality (*e.g.,* high bias recovery where the compound was not detected in associated samples).

1.5 Method Blanks

Method blanks were prepared and analyzed as required. No target analytes were detected at or above the MDLs in the method blanks, except for the following:

Method Blank ID	Analyte	Detection in Blank (µg/kg)	Affected Sample	Original Result (µg/kg)	Adjusted Results (µg/kg)
KWG1003073-MB	Dimethyl Phthalate	3.2 J	T115-SC-01-100127-ZA	15	15 U
			T115-SC-01-100127-ZB	11	11 U
			T115-SC-01-100127-ZC	9.2 J	39 U
			T115-SC-02-100127-ZB	13 J	41 U
			T115-SC-02-100127-ZC	4.8 J	8.4 U
			T115-SC-02-100127-ZD	7.3 J	8.4 U

Note: J – The value was at a level between the MDL and MRL, and considered as estimated.

1.6 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate percent recovery (%R) values were within the laboratory control limits.

1.7 Matrix Spike and Matrix Spike Duplicate (MS/MSD)

MS/MSD analyses were performed on sample T115-SC-01-100127-ZA. All %R and RPD values for the spiked compounds met the laboratory control criteria.

1.8 Laboratory Control Sample (LCS)

LCS and/or LCSD analyses were performed with each analytical batch. All %R and RPD values met the laboratory control limits.

1.9 Internal Standards

The method requires that (1) internal standard retention time be within ±30 seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within –50% to +100% of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

1.10 Target Compound Identification

Target compound identification is evaluated by examining if (1) the RRT is within ±0.06 RRT units of the standard RRT for a positively identified compound, (2) the relative intensity of characteristic ions are within ±30% in comparison with the reference spectrum, and (3) ions of a positively identified compound with >10% relative abundance should be present. No anomalies were found. Hexachlorophene results were determined using tentative identification compound search. The compound was not detected in any of the samples, and were qualified (UJ) due to the lack of calibration and QC measurements.

1.11 Compound Quantitation and Method Reporting Limits

The sample-specific MRLs were adjusted with sample amount extracted and supported with adequate initial calibration concentrations. The QAPP requirements for MRLs were achieved.

Verification calculations were performed on 10% of the instrument calibration, calibration verifications, and reported QC and sample analyses. No anomalies were found. Sample quantitation and reporting was correctly performed.

1.12 System Performance

The system performance and stability over an analytical sequence was evaluated by examining chromatograms for abrupt baseline shifting, excessive baseline rise at elevated temperature, progressing peak tailing, or loss of resolution. In addition, the internal standard retention times and response areas were checked for trends of shifting. No anomalies were observed.

1.13 Overall Assessment of Data Usability

SVOCs data are of known quality and acceptable for use, as qualified.

2. PCB Aroclors (SW846 Method 8082)

2.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. All samples were extracted and analyzed within the required holding times.

2.2 Initial Calibration

The method requires that (1) a minimum of 5-point calibration be performed using the mixture of Aroclor 1016 and 1260, (2) a single-point calibration be performed for the other five Aroclors to establish calibration factors (CFs) and for Aroclor pattern recognition, (3) at least 3 peaks (preferably 5 peaks) must be chosen for each Aroclor for characterization, (4) the %RSD values of Aroclor 1016 and 1260 CFs must be ≤ 20%, and (5) if dual column analysis is chosen, both columns should meet the requirements. The initial calibrations met the method requirements.

2.3 Calibration Verification

The method requires that (1) the initial calibration be verified prior to any analysis for each 12-hour analysis sequence, and (2) the percent drift (%D) be within ±15% to demonstrate the linearity of the initial calibration.

Calibration verifications were performed at the required frequency, and all %D values met the method criterion or the outliers had no effects on data quality (*e.g.,* high bias recovery where the compound was not detected in associated samples).

2.4 Blanks

Method Blanks: Method blanks were prepared and analyzed as required. PCB Aroclors were not detected at or above the MDLs in the method blanks.

Instrument Blank: Instrument blanks were analyzed and reported as required. PCB Aroclors were not detected at or above MDLs in the instrument blanks.

2.5 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike percent recovery (%R) values were within the laboratory control limits.

2.6 Matrix Spike and Matrix Spike Duplicate (MS/MSD)

MS/MSD analyses were performed on sample T115-SC-01-100127-ZA as requested. The Aroclor 1260 %R values were less than the lower project control limits. All sediment samples in this SDG may pose similar effects on Aroclor 1260 analyses; Aroclor 1260 results for all samples were qualified (J) as estimated. RPD values met the laboratory control criteria.

2.7 Laboratory Control Sample (LCS)

LCS analyses were performed as required by the method. All %R values met the laboratory control limits.

2.8 Target Compound Identification

All chromatograms were properly displayed and scaled. PCB Aroclors were not detected at or above the MDLs in any of the field samples.

2.9 Target Compound Quantitation and Reporting Limits

The sample-specific MRLs were adjusted with sample amount extracted and supported with adequate initial calibration concentrations. The QAPP requirements for MRLs were achieved.

Verification calculations were performed on 10% of the reported initial calibrations, calibration verifications, QC, and sample results. No anomalies were found.

2.10 Overall Assessment of PCB Aroclors Data Usability

PCB Aroclor data are of known quality and acceptable for use, as qualified.

3. Polychlorinated Dioxins/Furans by HRGC/HRMS (EPA Method 1613B)

3.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

EPA Method 1613B recommends a holding time of one year for solid samples stored in the dark at <-10°C. The NFG recommended that extracts be analyzed within 30 days of extraction. The sample was extracted and analyzed within the recommended holding times.

3.2 HRGC/HRMS Instrument Performance Check

The NFG and EPA Method 1613B criteria for instrument performance checks are as follows:

Mass Spectrometer Resolution: (1) The resolution check should be performed prior to initial calibration and at the start and end of each 12-hour shift, (2) the resolution should be ≥ 10,000 resolving power at m/z 304.9824, and (3) the deviation between the exact m/z and the theoretical m/z must be less than 5 ppm for monitored isomers.

Window Defining Mixture (WDM) and Column Performance Solution (CPS): (1) WDM and CPS should be analyzed prior to initial calibration and continuing calibration verification, and (2) the 2,3,7,8-TCDD peak and 1,2,3,8-TCDD peak should be resolved with a valley of ≤ 25%.

HRGC/HRMS instrument performance checks met the criteria.

3.3 Initial Calibration

The NFG and EPA Method 1613B criteria for initial calibration are as follows:

(1) A minimum of five standards should be employed,
(2) The percent relative standard deviation (%RSD) of isomer response should be <20% for native compounds and <35% for labeled compounds,
(3) The absolute RT of the internal standard $^{13}C_{12}$-1,2,3,4-TCDD must be >25 minutes on the DB-5 (or equivalent) column and >15 minutes on the DB-225 (or equivalent) column,
(4) The ion abundance ratios should be within the control limits listed in EPA Method 1613B, Table 9, and
(5) The signal-to-noise (S/N) ratio should be >10 for all native and labeled compounds in the first calibration standard (CS1).

Initial calibrations met all acceptance criteria.

3.4 Calibration Verification

The NFG and EPA Method 1613B criteria require that:

(1) Continuing calibration verifications be performed at the beginning of each 12-hour shift,
(2) The percent difference (%D) value be within the control limits listed in EPA Method 1613B, Table 6, and
(3) The ion abundance ratios, retention times, relative retention times, instrument sensitivity should meet the same criteria as for initial calibrations.

All calibration verification analyses met the criteria.

3.5 Blanks

Method Blank: A method blank was prepared and analyzed as required for each preparation batch. No target analytes were detected at or above the MRLs. 1,2,3,4,6,7,8-HpCDD and OCDD were detected in the method blank at levels greater than their estimated detection limits (EDLs) but less than their MRLs. All sample results were greater than 10 times the levels found in the method blanks; no data qualifying action was required.

Instrument Blank: An instrument blank was analyzed prior to the sample analyses in each analytical sequence. Target analytes were not detected at or above the EDLs.

3.6 Initial Precision and Recovery Study (IPR) and Ongoing Precision and Recovery (OPR)

The initial precision and recovery study was performed according to the laboratory, but results were not provided in the data package. A laboratory control sample (LCS) was analyzed in lieu of ongoing precision and recovery (OPR) analysis (see Section 3.8).

3.7 Labeled Compounds

Fifteen labeled compounds were added to all field and laboratory QC samples as required by the method. The percent recovery (%R) values met the method requirements (EPA Method 1613B, Table 7).

3.8 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed as required by the method. All %R and relative percent difference (RPD) values met the laboratory control limits,

3.9 Matrix Spike and Matrix Spike Duplicate (MS/MSD)

MS/MSD analyses were not performed on project samples in this SDG. Analytical precision and accuracy was evaluated with the LCS and LCSD results (see Section 3.8).

3.10 Target Compound Identification

Target compound identification was evaluated by examining if:

(1) the signals for the two exact m/z's being monitored were present, and maximized within ±2 seconds of one another;
(2) the S/N ratio of each of the two exact m/z's must be greater than or equal to 2.5;
(3) the ion abundance ratios were within the method control limits (EPA Method 1613B, Table 9); and
(4) the relative retention time (RRT) or retention time (RT) of the peaks were within the method control limits (EPA Method 1613B, Table 2).

All reported target analyte detections were properly identified.

3.11 Method Reporting Limits (MRLs) and Compound Quantitation

Correct internal standards, quantitation ions, and average RFs were used to quantitate target compound detections. The MRLs were supported with adequate ICAL calibration concentrations. Sample-specific EDLs and MRLs were adjusted with sample weights, internal standard peak height, and noise levels as required by the method.

Concentrations of octachlorodibenzo-*p*-dioxin (OCDD) in samples T115-SC-01-100127-ZB and T115-SC-01-100127-ZC exceeded the instrument calibration ranges. The results were qualified (J) as estimated.

A verification calculation was performed on 10% of the reported calibration, laboratory QC analyses, and sample results. No anomalies were found.

3.12 Second Column Confirmation

Second-column confirmation is required for samples analyzed on a DB-5 (or equivalent) column in which 2,3,7,8-TCDF is reported at or above the EDL, or where 2,3,7,8-TCDF is reported as an Estimated Maximum Possible Concentration (EMPC). 2,3,7,8-TCDF was detected in all samples and confirmed on the DB-225 column. The 2,3,7,8-TCDF values were reported from the DB-225 column as required.

3.13 Overall Assessment of Polychlorinated Dioxins/Furans Data Usability

Polychlorinated dioxins and furans data were of known quality and acceptable for use as qualified.

4. Total Organic Carbon (TOC) and Grain Size

4.1 Holding Times

Sediment samples should be analyzed within 28 days of collection for TOC and 6 months for grain size. All samples were analyzed within the required holding times.

4.2 Method Blank

Method blanks were prepared and analyzed for TOC as required. TOC was not detected at or above the RLs in the method blanks.

4.3 Replicate Analysis

Triplicate analyses were performed for TOC and grain size on sample T115-SC-03-100127-ZB. All %RSD values were within the acceptance criterion (20%).

4.4 Laboratory Control Sample (LCS)

The LCS analysis for TOC was performed as required by the method. All %R values were within the laboratory control limits.

4.5 Matrix Spike (MS)

TOC matrix spike analysis was performed on sample T115-SC-03-100127-ZB. The %R value was within the laboratory control criterion (75 – 125%).

4.6 Overall Assessment of TOC and Grain Size Data Usability

TOC and grain size data are of known quality and acceptable for use.

SUMMARY

Data qualification and reasons are summarized as follows:

Sample ID	Analyte	Data Qualifier	Reason	Report Section
T115-SC-01-100127-ZA T115-SC-01-100127-ZB T115-SC-01-100127-ZC T115-SC-01-100127-ZD T115-SC-02-100127-ZA T115-SC-02-100127-ZB T115-SC-02-100127-ZC T115-SC-02-100127-ZD	Aroclor 1260	**J**	The MS and MSD %R values were less than the lower control limits.	
T115-SC-01-100127-ZB T115-SC-01-100127-ZC	Octachlorodibenzo-*p*-dioxin (OCDD)	**J**	The reported value exceeded calibration range.	**3.11**

Data affected by associated blanks are qualified and results adjusted as follows:

Sample ID	Analyte	Original Result	Adjusted Result	Unit	Report Section
T115-SC-01-100127-ZA	Dimethyl Phthalate	8.3 J	**42 U**	**µg/kg**	**1.5**
T115-SC-01-100127-ZB		11 J	**72 U**		
T115-SC-01-100127-ZC		1.2 J	**5.5 U**		
T115-SC-02-100127-ZB		5.6 J	**41 U**		
T115-SC-02-100127-ZC		1.6 J	**6.6 U**		
T115-SC-02-100127-ZD					

Data Qualifiers are defined as follows:

Data Qualifier	Definition
J	The analyte was detected above the reported quantitation limit, and the reported concentration was an estimated value.
U	The analyte was analyzed for, but was considered not detected at the reporting limit or reported value.
UJ	The analyte was analyzed for, and the associated quantitation limit was an estimated value.

Approved By: _____ Date: _____

Mingta Lin

REFERENCES

USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, Office of Superfund Remediation and Technology Innovation, U.S. Environmental Protection Agency, June 2008, EPA-540-R-08-01.

USEPA Analytical Operations/Data Quality Center National Functional Guidelines for Chlorinated Dioxin/Furan Data Review, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, September 2005, EPA 540/R-05-001.

USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, December 1996.

USEPA Method 1613 Tetra- Through Octa-Chlorinated Dioxins and Furans by Isotope Dilution HRGC/HRMS, October 1994.

USEPA Region 10 Standard Operating Procedure for the Validation of Polychlorinated Dibenzo-p-dioxin (PCDD) and Polychlorinated Dibenzo-furan (PCDF) Data, January 1996.

Recommended Protocols for Measuring Conventional Sediment Variables in Puget Sound, Puget Sound Water Quality Authority, March 1986.

Recommended Guidelines for Measuring Organic Compounds in Puget Sound Water, Sediment and Tissue Samples, Puget Sound Water Quality Authority, April 1997.

Port of Seattle, Terminal 115 Post-Dredge Subsurface Sediment Characterization, Quality Assurance Project Plan, Anchor QEA, LLC., June 2009.

Data Validation Report

Port of Seattle Terminal 115
Post-Dredge Subsurface Sediment Characterization
March 2010 Sampling

Prepared for:

Science and Engineering for the Environment, LLC.
4401 Latona Ave NE
Seattle, WA 98105

Prepared by:

Pyron Environmental, Inc.
3530 32nd Way NW
Olympia, WA 98502

May 5, 2010

ACRONYMS

%D	percent difference
%D_f	percent drift
%R	percent recovery
%RSD	percent relative standard deviation
CDD	chlorinated dibenzo-p-dioxin
CDF	chlorinated dibenzofuran
CF	calibration factor
CLP	U.S. EPA Contract Laboratory Program
COC	chain-of-custody
DFTPP	decafluorotriphenylphosphine
ECD	electron capture detector
EMPC	estimated maximum possible concentration
EPA	U.S. Environmental Protection Agency
GC/MS	gas chromatograph/mass spectrometer
HRGC	high-resolution gas chromatograph
HRMS	high-resolution mass spectrometer
ICAL	initial calibration
IPR	initial precision and recovery
ISC	isomer specificity check
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
mg/kg	milligram per kilogram
µg/kg	microgram per kilogram
MDL	method detection limit
MS	matrix spike
MSD	matrix spike duplicate
m/z	mass-to-charge ratio
ng/kg	nanogram per kilogram
NFGs	CLP National Functional Guidelines for Data Review (EPA 2008 – Organics, EPA 2005 - Dioxins and Furans)
OPR	ongoing precision and recovery
PCBs	polychlorinated biphenyls
PCDD	polychlorinated dibenzo-p-dioxin

PCDF	polychlorinated dibenzofuran
PEM	performance evaluation mixture
QAPP	quality assurance project plan
QA/QC	quality assurance/quality control
RF	response factor
RL	reporting limit
RPD	relative percent difference
SDG	sample delivery group
SICP	selected ion current profile
S/N	signal-to-noise ratio
SVOCs	semi-volatile organic compounds
WDM	window defining mixture

INTRODUCTION

This report presents and discusses findings of the data validation performed on analytical data for samples collected during March 2010 for the referenced project. The laboratory report validated herein was submitted by Columbia Analytical Services, Inc. in one sample delivery group (SDG) – K1002313.

A level IV data validation was performed. The validation followed the procedures specified in USEPA CLP National Functional Guidelines ([NFGs], EPA 2008 – Organics, EPA 2005 – Chlorinated Dioxin/Furans), with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with those specified in the quality assurance project plans ([QAPPs], Anchor, June 2009) and the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the respective analytical methods.

Validation findings are discussed for each QC parameter pertinent to each type of analyses evaluated. Qualified data with applied data qualifiers are summarized in the **Summary** section at the end of this report. As part of the level IV validation, 10 percent of the initial calibrations, calibration verifications, laboratory QC analyses, and sample results were verified via re-calculation checks.

Samples and the associated analyses validated herein are summarized as follows:

Field Sample ID	Laboratory Sample ID	Sampling Date	Matrix	Analysis			
				SVOCs	PCBs	Dioxins/ Furans	TOC Grain Size
T115 SC032 100310ZA	K1002313-001	3/10/2010	Sediment	X	X	X	X
T115 SC032 100310ZB	K1002313-002	3/10/2010	Sediment	X	X	X	X
T115 SC032 100310ZC	K1002313-003	3/10/2010	Sediment	X	X	X	X
T115 SC032 100310ZD	K1002313-004	3/10/2010	Sediment	X	X	X	X
T115 SC0532 100310ZA	K1002313-005	3/10/2010	Sediment	X	X	X	X
T115 SC042 100310ZA	K1002313-006	3/10/2010	Sediment	X	X	X	X
T115 SC042 100310ZB	K1002313-007	3/10/2010	Sediment	X	X	X	X
T115 SC042 100310ZC	K1002313-008	3/10/2010	Sediment	X	X	X	X
T115 SC042 100310ZD	K1002313-009	3/10/2010	Sediment	X	X	X	X
T115 SC043 100310ZA	K1002313-010	3/10/2010	Sediment	X	X	X	X

Notes:
X - The analysis was requested and performed on the sample
SVOCs – Semi-volatile organic compounds, analyte list specified in the QAPP
PCBs – Polychlorinated biphenyls (Aroclors only)
Dioxins/Furans – Polychlorinated dioxins & furans
TOC – Total organic carbon

Analytical methods in respect to analytical parameters validated herein and the laboratory performing the analyses are summarized below:

Parameter	Analytical Method	Laboratory
TOC	Plumb, 1981	Columbia Analytical Services, Inc. (CAS), Kelso, Washington
Grain Size	PSEP Protocols	
PCB Aroclors	SW846 Method 8082	
SVOCs	SW846 Method 8270C	
Polychlorinated Dioxins & Furans	EPA Method 1613B	Columbia Analytical Services, Inc. (CAS), Houston, Texas

Notes:

1. SW846 Methods - *USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,* SW-846, Third Edition, December 1996 and Updates.
2. *USEPA Method 1613 Tetra- Through Octa-Chlorinated Dioxins and Furans by Isotope Dilution HRGC/HRMS,* October 1994.
3. PSEP Protocols - *PSEP Recommended Protocols for Measuring Conventional Sediment Variables in Puget Sound,* Puget Sound Water Quality Authority, March 1986.
4. Plumb 1981 - *Procedures for Handling and Chemical Analysis of Sediment and Water Samples.* Technical Report, EPA/CE-B1-1. U.S. Army Corps of Engineers. Plumb, R.H. 1981.

DATA VALIDATION FINDINGS

1. Semi-volatile Organic Compounds (SVOCs) by GC/MS (SW846 Method 8270C)

1.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. All samples were extracted and analyzed within the required holding times.

1.2 GC/MS Instrument Performance Check

DFTPP tuning was performed within each 12-hour interval. All required ion abundance ratios met the method requirements.

1.3 Initial Calibration

The NFGs criteria require that the average response factor (RF) be ≥0.05 for all analytes and surrogate compounds.

The method linearity criteria require that (1) if linear average RFs is chosen as the quantitation option, the %RSD of RFs be ≤15% for the analyte, (2) if least-square linear regression is chosen for quantitation, the correlation coefficient (r) be ≥0.99, and (3) if six-point non-linear (quadratic) curve is chosen for quantitation, the coefficient of determination (r^2) be ≥0.99.

1.4 Calibration Verification

The NFGs criteria require that (1) continuing calibrations be analyzed at the beginning of each 12-hour analysis period prior to the analysis of method blank and samples, (2) the percent difference (%D) be within ±20%, and (3) the RF be ≥0.05 for all analytes and surrogate compounds.

Calibration verifications were performed at the required frequency, and all %D values met the method criterion or the outliers had no effects on data quality (*e.g.,* high bias recovery where the compound was not detected in associated samples).

1.5 Method Blanks

Method blanks were prepared and analyzed as required. No target analytes were detected at or above the MDLs in the method blanks, except for the following:

Method Blank ID	Analyte	Detection in Blank (µg/kg)	Affected Sample	Original Result (µg/kg)	Adjusted Results (µg/kg)
KWG1002463-MB	Dimethyl Phthalate	2.3 J	T115 SC032 100310ZA	8.3 J	42 U
			T115 SC032 100310ZB	11 J	72 U
			T115 SC032 100310ZC	1.2 J	5.5 U
			T115 SC0532 100310ZA	5.6 J	41 U
			T115 SC043 100310ZA	1.6 J	6.6 U

Note: J – The value was at a level between the MDL and MRL, and considered as estimated.

1.6 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate percent recovery (%R) values were within the laboratory control limits.

1.7 Matrix Spike and Matrix Spike Duplicate (MS/MSD)

MS/MSD analyses were performed on sample T115 SC042 100310ZA. All %R and RPD values for the spiked compounds met the laboratory control criteria.

1.8 Laboratory Control Sample (LCS)

LCS analyses were performed with each analytical batch. All %R and RPD values met the laboratory control limits.

1.9 Internal Standards

The method requires that (1) internal standard retention time be within ±30 seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within –50% to +100% of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

1.10 Target Compound Identification

Target compound identification is evaluated by examining if (1) the RRT is within ±0.06 RRT units of the standard RRT for a positively identified compound, (2) the relative intensity of characteristic ions are within ±30% in comparison with the reference spectrum, and (3) ions of a positively identified compound with >10% relative abundance should be present. No anomalies were found. Hexachlorophene results were determined using tentative identification compound search. The compound was not detected in any of the samples, and were qualified (UJ) due to the lack of calibration and QC measurements.

1.11 Compound Quantitation and Method Reporting Limits

The sample-specific MRLs were adjusted with sample amount extracted and supported with adequate initial calibration concentrations. The QAPP requirements for MRLs were achieved.

Verification calculations were performed on 10% of the instrument calibration, calibration verifications, and reported QC and sample analyses. No anomalies were found. Sample quantitation and reporting was correctly performed.

1.12 System Performance

The system performance and stability over an analytical sequence was evaluated by examining chromatograms for abrupt baseline shifting, excessive baseline rise at elevated temperature, progressing peak tailing, or loss of resolution. In addition, the internal standard retention times and response areas were checked for trends of shifting. No anomalies were observed.

1.13 Field Duplicates

Samples T115 SC032 100310ZA and T115 SC0532 100310ZA were field duplicates. The results and data qualification are presented in **Appendix A** in the end of this report.

1.14 Overall Assessment of Data Usability

SVOCs data are of known quality and acceptable for use, as qualified.

2. PCB Aroclors (SW846 Method 8082)

2.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. All samples were extracted and analyzed within the required holding times.

2.2 Initial Calibration

The method requires that (1) a minimum of 5-point calibration be performed using the mixture of Aroclor 1016 and 1260, (2) a single-point calibration be performed for the other five Aroclors to establish calibration factors (CFs) and for Aroclor pattern recognition, (3) at least 3 peaks (preferably 5 peaks) must be chosen for each Aroclor for characterization, (4) the %RSD values of Aroclor 1016 and 1260 CFs must be ≤ 20%, and (5) if dual column analysis is chosen, both columns should meet the requirements. The initial calibrations met the method requirements.

2.3 Calibration Verification

The method requires that (1) the initial calibration be verified prior to any analysis for each 12-hour analysis sequence, and (2) the percent drift (%D) be within ±15% to demonstrate the linearity of the initial calibration.

Calibration verifications were performed at the required frequency, and all %D values met the method criterion or the outliers had no effects on data quality (*e.g.,* high bias recovery where the compound was not detected in associated samples).

2.4 Blanks

Method Blanks: Method blanks were prepared and analyzed as required. PCB Aroclors were not detected at or above the MDLs in the method blanks.

Instrument Blank: Instrument blanks were analyzed and reported as required. PCB Aroclors were not detected at or above MDLs in the instrument blanks.

2.5 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike percent recovery (%R) values were within the laboratory control limits.

2.6 Matrix Spike and Matrix Spike Duplicate (MS/MSD)

MS/MSD analyses were performed on sample T115 SC042 100310ZA as requested. All %R and RPD values met the laboratory control criteria.

2.7 Laboratory Control Sample (LCS)

LCS analyses were performed as required by the method. All %R values met the laboratory control limits.

2.8 Target Compound Identification

All chromatograms were properly displayed and scaled. PCB Aroclors were not detected at or above the MDLs in any of the field samples.

2.9 Target Compound Quantitation and Reporting Limits

The sample-specific MRLs were adjusted with sample amount extracted and supported with adequate initial calibration concentrations. The QAPP requirements for MRLs were achieved.

Verification calculations were performed on 10% of the reported initial calibrations, calibration verifications, QC, and sample results. No anomalies were found.

2.10 Field Duplicates

Samples T115 SC032 100310ZA and T115 SC0532 100310ZA were field duplicates. The results and data qualification are presented in **Appendix A** in the end of this report.

2.11 Overall Assessment of PCB Aroclors Data Usability

PCB Aroclors data are of known quality and acceptable for use, as qualified.

3. Polychlorinated Dioxins/Furans by HRGC/HRMS (EPA Method 1613B)

3.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

EPA Method 1613B recommends a holding time of one year for solid samples stored in the dark at <-10°C. The NFG recommended that extracts be analyzed within 30 days of extraction. The sample was extracted and analyzed within the recommended holding times.

3.2 HRGC/HRMS Instrument Performance Check

The NFG and EPA Method 1613B criteria for instrument performance checks are as follows:

Mass Spectrometer Resolution: (1) The resolution check should be performed prior to initial calibration and at the start and end of each 12-hour shift, (2) the resolution should be ≥ 10,000 resolving power at m/z 304.9824, and (3) the deviation between the exact m/z and the theoretical m/z must be less than 5 ppm for monitored isomers.

Window Defining Mixture (WDM) and Column Performance Solution (CPS): (1) WDM and CPS should be analyzed prior to initial calibration and continuing calibration verification, and (2) the 2,3,7,8-TCDD peak and 1,2,3,8-TCDD peak should be resolved with a valley of ≤ 25%.

All HRGC/HRMS instrument performance checks met the criteria.

3.3 Initial Calibration

The NFG and EPA Method 1613B criteria for initial calibration are as follows:

(1) A minimum of five standards should be employed,
(2) The percent relative standard deviation (%RSD) of isomer response should be <20% for native compounds and <35% for labeled compounds,
(3) The absolute RT of the internal standard $^{13}C_{12}$-1,2,3,4-TCDD must be >25 minutes on the DB-5 (or equivalent) column and >15 minutes on the DB-225 (or equivalent) column,

(4) The ion abundance ratios should be within the control limits listed in EPA Method 1613B, Table 9, and
(5) The signal-to-noise (S/N) ratio should be >10 for all native and labeled compounds in the first calibration standard (CS1).

Initial calibrations met all acceptance criteria.

3.4 Calibration Verification

The NFG and EPA Method 1613B criteria require that:

(1) Continuing calibration verifications be performed at the beginning of each 12-hour shift,
(2) The percent difference (%D) value be within the control limits listed in EPA Method 1613B, Table 6, and
(3) The ion abundance ratios, retention times, relative retention times, instrument sensitivity should meet the same criteria as for initial calibrations.

All calibration verification analyses met the criteria.

3.5 Blanks

Method Blank: A method blank was prepared and analyzed as required for each preparation batch. No target analytes were detected at or above the estimated detection limits (EDLs), except for the following:

Method Blank ID	Analyte	Detection in Blank (ng/kg)	Affected Sample	Original Result (ng/kg)	Adjusted Result (ng/kg)
EQ10000128-01	1,2,3,4,6,7,8-Heptachlorodibenzo-*p*-dioxin (HpCDD)	0.242 J	T115 SC032 100310ZD T115 SC042 100310ZA T115 SC042 100310ZC T115 SC042 100310ZD	3.24 J 0.402 J 0.485 J 0.401 J	5.86 U 5.43 U 5.6 U 5.43 U
EQ10000128-01	Octachlorodibenzo-*p*-dioxin (OCDD)	1.62 J	T115 SC042 100310ZA T115 SC042 100310ZB T115 SC042 100310ZC T115 SC042 100310ZD	2.57 J 10.2 J 3.55 J 3.95 J	10.9 U 11.2 U 11.2 U 10.9 U
EQ10000128-01	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	0.0754 J	T115 SC032 100310ZD T115 SC042 100310ZA T115 SC042 100310ZB	0.394 J 0.0893 J 0.0895 J	5.86 U 5.43 U 5.6 U
EQ10000128-01	Octachlorodibenzofuran (OCDF)	0.211 J	T115 SC032 100310ZD T115 SC042 100310ZB	1.11 J 0.256 J	11.7 U 11.2 U

Note: J – The value was at a level between the EDL and MRL, and considered as estimated.

3.6 Initial Precision and Recovery Study (IPR) and Ongoing Precision and Recovery (OPR)

The initial precision and recovery study was performed according to the laboratory, but results were not provided in the data package. A laboratory control sample (LCS) was analyzed in lieu of ongoing precision and recovery (OPR) analysis (see Section 3.8).

3.7 Labeled Compounds

Fifteen labeled compounds were added to all field and laboratory QC samples as required by the method. The percent recovery (%R) values met the method requirements (EPA Method 1613B, Table 7).

3.8 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed as required by the method. All %R and relative percent difference (RPD) values met the laboratory control limits,

3.9 Matrix Spike and Matrix Spike Duplicate (MS/MSD)

MS/MSD analyses were performed on sample T115 SC042 100310ZA as requested. All %R and RPD values met the laboratory control criteria.

3.10 Target Compound Identification

Target compound identification was evaluated by examining if:

(1) the signals for the two exact m/z's being monitored were present, and maximized within ±2 seconds of one another;
(2) the S/N ratio of each of the two exact m/z's must be greater than or equal to 2.5;
(3) the ion abundance ratios were within the method control limits (EPA Method 1613B, Table 9); and
(4) the relative retention time (RRT) or retention time (RT) of the peaks were within the method control limits (EPA Method 1613B, Table 2).

All reported target analyte detections were properly identified.

3.11 Method Reporting Limits (MRLs) and Compound Quantitation

Correct internal standards, quantitation ions, and average RFs were used to quantitate target compound detections. The MRLs were supported with adequate ICAL calibration concentrations. Sample-specific EDLs and MRLs were adjusted with sample weights, internal standard peak height, and noise levels as required by the method.

Concentrations of octachlorodibenzo-*p*-dioxin (OCDD) in samples T115 SC0532 100310ZA and T115 SC043 100310ZA exceeded the instrument calibration ranges. The results were qualified (J) as estimated.

A verification calculation was performed on 10% of the reported calibration, laboratory QC analyses, and sample results. No anomalies were found.

3.12 Second Column Confirmation

Second-column confirmation is required for samples analyzed on a DB-5 (or equivalent) column in which 2,3,7,8-TCDF is reported at or above the EDL, or where 2,3,7,8-TCDF is reported as an Estimated Maximum Possible Concentration (EMPC). 2,3,7,8-TCDF was detected in all samples and confirmed on the DB-225 column. The 2,3,7,8-TCDF values were reported from the DB-225 column as required.

3.13 Field Duplicates

Samples T115 SC032 100310ZA and T115 SC0532 100310ZA were field duplicates. The results and data qualification are presented in **Appendix A** in the end of this report.

3.14 Overall Assessment of Polychlorinated Dioxins/Furans Data Usability

Polychlorinated dioxins and furans data were of known quality and acceptable for use as qualified.

4. Total Organic Carbon (TOC) and Grain Size

4.1 Holding Times

Sediment samples should be analyzed within 28 days of collection for TOC and 6 months for grain size. All samples were analyzed within the required holding times.

4.2 Method Blank

Method blanks were prepared and analyzed for TOC as required. TOC was not detected at or above the RLs in the method blanks.

4.3 Replicate Analysis

Triplicate analyses were performed for TOC and grain size on sample T115 SC042 100310ZA. All %RSD values were within the acceptance criterion (20%).

4.4 Laboratory Control Sample (LCS)

The LCS analysis for TOC was performed as required by the method. All %R values were within the laboratory control limits.

4.5 Matrix Spike (MS)

TOC matrix spike analysis was performed on sample T115 SC042 100310ZA. The %R value was within the laboratory control criterion (75 – 125%).

4.6 Field Duplicates

Samples T115 SC032 100310ZA and T115 SC0532 100310ZA were field duplicates. The results and data qualification are presented in **Appendix A** in the end of this report.

4.7 Overall Assessment of TOC and Grain Size Data Usability

TOC and grain size data are of known quality and acceptable for use.

SUMMARY

Data qualification and reasons are summarized as follows:

Sample ID	Analyte	Data Qualifier	Reason	Report Section
T115 SC0532 100310ZA T115 SC043 100310ZA	Octachlorodibenzo-*p*-dioxin (OCDD)	**J**	The reported value exceeded calibration range.	**3.11**
T115 SC032 100310ZA T115 SC0532 100310ZA	1,2,3,4,6,7,8-Heptachlorodibenzo-*p*-dioxin (HpCDD)	**J**	The field duplicate results were outside the precision criteria.	**Appendix A**
T115 SC032 100310ZA	Octachlorodibenzo-*p*-dioxin (OCDD)	**J**	The field duplicate results were outside the precision criteria.	**Appendix A**

Data affected by associated blanks are qualified and results adjusted as follows:

Sample ID	Analyte	Original Result	Adjusted Result	Unit	Report Section
T115 SC032 100310ZA T115 SC032 100310ZB T115 SC032 100310ZC T115 SC0532 100310ZA T115 SC043 100310ZA	Dimethyl Phthalate	8.3 J 11 J 1.2 J 5.6 J 1.6 J	**42 U** **72 U** **5.5 U** **41 U** **6.6 U**	**µg/kg**	**1.5**
T115 SC032 100310ZD T115 SC042 100310ZA T115 SC042 100310ZC T115 SC042 100310ZD	1,2,3,4,6,7,8-Heptachlorodibenzo-*p*-dioxin (HpCDD)	3.24 J 0.402 J 0.485 J 0.401 J	**5.86 U** **5.43 U** **5.6 U** **5.43 U**	**ng/kg**	**3.5**
T115 SC042 100310ZA T115 SC042 100310ZB T115 SC042 100310ZC T115 SC042 100310ZD	Octachlorodibenzo-*p*-dioxin (OCDD)	2.57 J 10.2 J 3.55 J 3.95 J	**10.9 U** **11.2 U** **11.2 U** **10.9 U**	**ng/kg**	**3.5**
T115 SC032 100310ZD T115 SC042 100310ZA T115 SC042 100310ZB	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	0.394 J 0.0893 J 0.0895 J	**5.86 U** **5.43 U** **5.6 U**	**ng/kg**	**3.5**
T115 SC032 100310ZD T115 SC042 100310ZB	Octachlorodibenzofuran (OCDF)0.211 J	1.11 J 0.256 J	**11.7 U** **11.2 U**	**ng/kg**	**3.5**

Data Qualifiers are defined as follows:

Data Qualifier	Definition
J	The analyte was detected above the reported quantitation limit, and the reported concentration was an estimated value.
R	The result was rejected and could not be used.
U	The analyte was analyzed for, but was considered not detected at the reporting limit or reported value.
UJ	The analyte was analyzed for, and the associated quantitation limit was an estimated value.

Approved By: _____ Date: _____

Mingta Lin

REFERENCES

USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, Office of Superfund Remediation and Technology Innovation, U.S. Environmental Protection Agency, June 2008, EPA-540-R-08-01.

USEPA Analytical Operations/Data Quality Center National Functional Guidelines for Chlorinated Dioxin/Furan Data Review, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, September 2005, EPA 540/R-05-001.

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USEPA Method 1613 Tetra- Through Octa-Chlorinated Dioxins and Furans by Isotope Dilution HRGC/HRMS, October 1994.

USEPA Region 10 Standard Operating Procedure for the Validation of Polychlorinated Dibenzo-p-dioxin (PCDD) and Polychlorinated Dibenzo-furan (PCDF) Data, January 1996.

Recommended Protocols for Measuring Conventional Sediment Variables in Puget Sound, Puget Sound Water Quality Authority, March 1986.

Recommended Guidelines for Measuring Organic Compounds in Puget Sound Water, Sediment and Tissue Samples, Puget Sound Water Quality Authority, April 1997.

Port of Seattle, Terminal 115 Post-Dredge Subsurface Sediment Characterization, Quality Assurance Project Plan, Anchor QEA, LLC., June 2009.

Appendix A

Field duplicate RPD is indicative of field and laboratory precision and sample homogeneity in combination. The precision criterion of 50% specified in the QAPP was applied to evaluating the RPD values of soil field duplicate results ≥5xMRL. For results that are <5xMRL, an advisory criterion of ±2xMRL was applied to evaluating the concentration differences. The RPD (or concentration difference as applicable) values and data qualification for detected compounds in field duplicates are presented as follows:

Analytes	MRL	Unit	Sample ID & Results		RPD (%) or Difference	Data Qualification
			T115 SC032 100310ZA	T115 SC0532 100310ZA		
Solids, Total	0.1	%	60.5	61.8	2%	
Carbon, Total Organic (TOC)	0.05	%	1.88	2.04	8%	
Gravel	0.1	%	0.77	0.56	32%	
Sand, Very Coarse	0.1	%	1.45	1.39	4%	
Sand, Coarse	0.1	%	1.62	2.47	42%	
Sand, Medium	0.1	%	3.16	3.2	1%	
Sand, Fine	0.1	%	3.62	3.55	2%	
Sand, Very Fine	0.1	%	15.7	14.3	9%	
Silt	0.1	%	61	54.5	11%	
Clay	0.1	%	11.9	13.2	10%	
Aroclor 1242	8.3	µg/kg	86	87	1%	
Aroclor 1254	8.3	µg/kg	130	120	8%	
Aroclor 1260	8.3	µg/kg	95	75	24%	
Phenol	130	µg/kg	20 J	16 J	4 µg/kg	
Naphthalene	21	µg/kg	17 J	16 J	1 µg/kg	
2-Methylnaphthalene	21	µg/kg	13 J	12 J	1 µg/kg	
Acenaphthylene	21	µg/kg	16 J	18 J	2 µg/kg	
Dimethyl Phthalate	42	µg/kg	8.3 J	5.6 J	2.7 µg/kg	
Acenaphthene	21	µg/kg	19 J	17 J	2 µg/kg	
Dibenzofuran	42	µg/kg	16 J	14 J	2 µg/kg	
Fluorene	21	µg/kg	26	24 J	2 µg/kg	
Diethyl Phthalate	42	µg/kg	12 J	41 J	29 µg/kg	
N-Nitrosodiphenylamine	42	µg/kg	13 J	9.7 J	3.3 µg/kg	
Phenanthrene	21	µg/kg	130	130	0%	
Anthracene	21	µg/kg	48	44	4 µg/kg	

Fluoranthene	21	µg/kg	330	450	31%	
Pyrene	21	µg/kg	840	860	2%	
Butyl Benzyl Phthalate	42	µg/kg	72	66	6 µg/kg	
Benz(a)anthracene	21	µg/kg	150	190	24%	
Chrysene	21	µg/kg	190	210	10%	
Bis(2-ethylhexyl) Phthalate	420	µg/kg	320 J	230 J	90 µg/kg	
Benzo(b)fluoranthene	21	µg/kg	340	350	3%	
Benzo(k)fluoranthene	21	µg/kg	110	120	9%	
Benzo(a)pyrene	21	µg/kg	210	220	5%	
Indeno(1,2,3-cd)pyrene	21	µg/kg	120	120	0%	
Dibenz(a,h)anthracene	21	µg/kg	34	35	1 µg/kg	
Benzo(g,h,i)perylene	21	µg/kg	78	74	4 µg/kg	
1,2,3,7,8-Pentachlorodibenzo-*p*-dioxin (PeCDD)	8.14	ng/Kg	1.26 J	1.87 J	0.61 ng/kg	
1,2,3,4,7,8-Hexachlorodibenzo-*p*-dioxin (HxCDD)	8.14	ng/Kg	1.01 J	1.89 J	0.88 ng/kg	
1,2,3,6,7,8-Hexachlorodibenzo-*p*-dioxin (HxCDD)	8.14	ng/Kg	8.61	17.2	8.59 ng/kg	
1,2,3,7,8,9-Hexachlorodibenzo-*p*-dioxin (HxCDD)	8.14	ng/Kg	5.63 J	12.7	7.07 ng/kg	
1,2,3,4,6,7,8-Heptachlorodibenzo-*p*-dioxin (HpCDD)	8.14	ng/Kg	303	885	98%	**J/J**
Octachlorodibenzo-*p*-dioxin (OCDD)	16.3	ng/Kg	2380	8500 E	113%	**J/J**
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	8.14	ng/Kg	0.319 J	0.535 J	0.216 ng/kg	
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	8.14	ng/Kg	0.442 J	0.979 J	0.537 ng/kg	

Note: J – The value is between the MDL and RL and considered estimated. E – The value exceeded calibration range and is an estimated value.

Appendix I

Sand Cover Chemical Data Package

ANCHOR QEA
1423 Third Avenue, Suite 300
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131

Submittal Review Transmittal

Contractor:
Pacific Pile and Marine

Subcontractor:
N/A

Project Name:
Port of Seattle
Terminal 115 Berth 1 Modifications

Project Number:
Port Project No. 103773
Port Contract No. MC-0316208

Date: December 31, 2009

Submittal Number: 02334-001

Check:
☒ Original Submittal ☐ Re-submittal ☐ Other

Item No.	Specification Reference	Description	Other
1	02334	Clean Sand Cover Chemistry Results	

Review action:

☒ No Exceptions Taken
☐ Make Corrections Noted
☐ Revise and Re-Submit
☐ Rejected
☐ Submit Specified Item

Checking is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Any action shown is subject to the requirements of the plans and specifications and does not relieve the contractor from compliance with contract requirements. Contractor is responsible for: confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe and satisfactory manner.

By: John P. Laplante, PE

Cc:

SPECTRA Laboratories

2221 Ross Way • Tacoma, WA 98421 • (253) 272-4850 • Fax (253) 572-9838 • www.spectra-lab.com

12/29/2009

Cal Portland - Pioneer Aggregates
4301 Pioneer Avenue
DuPont, WA 98327
Attn: Mike Skrivan

Project: Terminal #115
Client ID: Comp-1
Sample Matrix: Soil
Date Sampled: 12/17/2009
Date Received: 12/17/2009
Spectra Project: 2009120317
Spectra Number: 1

Analyte	Result	Units	Method	Analyte	Result	Units	Method
1,2,4-Trichlorobenzene--SIM	<3.3	ug/Kg	8270D--SIM	Di-n-Octyl Phthalate--SIM	<3.3	ug/Kg	8270D--SIM
1,2-Dichlorobenzene--SIM	<3.3	ug/Kg	8270D--SIM	Dibenz(a,h)Anthracene--SIM	<3.3	ug/Kg	8270D--SIM
1,3-Dichlorobenzene--SIM	<3.3	ug/Kg	8270D--SIM	Dibenzofuran--SIM	<3.3	ug/Kg	8270D--SIM
1,4-Dichlorobenzene--SIM	<3.3	ug/Kg	8270D--SIM	Diethylphthalate--SIM	<3.3	ug/Kg	8270D--SIM
2,4-Dimethylphenol--SIM	<3.3	ug/Kg	8270D--SIM	Dimethyl Phthalate--SIM	<3.3	ug/Kg	8270D--SIM
2-Methylnaphthalene--SIM	<3.3	ug/Kg	8270D--SIM	Fluoranthene--SIM	<3.3	ug/Kg	8270D--SIM
2-Methylphenol--SIM	<3.3	ug/Kg	8270D--SIM	Fluorene--SIM	<3.3	ug/Kg	8270D--SIM
4-Methylphenol--SIM	<3.3	ug/Kg	8270D--SIM	Hexachlorobenzene--SIM	<3.3	ug/Kg	8270D--SIM
Acenaphthene--SIM	<3.3	ug/Kg	8270D--SIM	Hexachlorobutadiene--SIM	<3.3	ug/Kg	8270D--SIM
Acenaphthylene--SIM	<3.3	ug/Kg	8270D--SIM	Indeno(1,2,3-cd)Pyrene--SIM	<3.3	ug/Kg	8270D--SIM
Anthracene--SIM	<3.3	ug/Kg	8270D--SIM	N-Nitrosodiphenylamine--SI	<3.3	ug/Kg	8270D--SIM
Benzo(a)Anthracene--SIM	<3.3	ug/Kg	8270D--SIM	Naphthalene--SIM	<3.3	ug/Kg	8270D--SIM
Benzo(a)Pyrene--SIM	<3.3	ug/Kg	8270D--SIM	Pentachlorophenol--SIM	<3.3	ug/Kg	8270D--SIM
Benzo(b)Fluoranthene--SIM	<3.3	ug/Kg	8270D--SIM	Phenanthrene--SIM	<3.3	ug/Kg	8270D--SIM
Benzo(ghi)Perylene--SIM	<3.3	ug/Kg	8270D--SIM	Phenol--SIM	<3.3	ug/Kg	8270D--SIM
Benzo(k)Fluoranthene--SIM	<3.3	ug/Kg	8270D--SIM	Pyrene--SIM	<3.3	ug/Kg	8270D--SIM
Benzoic Acid--SIM	<20	ug/Kg	8270D--SIM	Total HPAH--SIM	<33	ug/Kg	8270D--SIM
Benzyl Alcohol--SIM	<20	ug/Kg	8270D--SIM	Total LPAH--SIM	<25	ug/Kg	8270D--SIM
Butylbenzylphthalate--SIM	<3.3	ug/Kg	8270D--SIM	bis(2-Ethylhexyl)Phthalate--S	9.29	ug/Kg	8270D--SIM
Chrysene--SIM	<3.3	ug/Kg	8270D--SIM	Grainsize	**		ASTM D-422
Di-n-Butylphthalate--SIM	4.12	ug/Kg	8270D--SIM	Dioxins and Furans	*		EPA 8290

* Dioxins and Furans were subcontracted to Analytical Perspectives. ** Grainsize was subcontracted to Analytical Resources, Inc. Please see complete results enclosed.

Surrogate	Recovery	Method
2-Fluorophenol--SIM	66	8270D--SIM
Phenol-d6--SIM	65	8270D--SIM
Nitrobenzene-d5--SIM	103	8270D--SIM
2-Fluorobiphenyl--SIM	92	8270D--SIM

Surrogate	Recovery	Method
2,4,6-Tribromophenol--SIM	60	8270D--SIM
p-Terphenyl-d14--SIM	102	8270D--SIM
Decachlorobiphenyl	91	SW846 8082A

SPECTRA LABORATORIES

for

Steve Hibbs, Laboratory Manager
a14/mlh

SPECTRA Laboratories

2221 Ross Way • Tacoma, WA 98421 • (253) 272-4850 • Fax (253) 572-9838 • www.spectra-lab.com

12/29/2009

Project: Terminal #115
Client ID: Comp-1
Sample Matrix: Soil
Date Sampled: 12/17/2009
Date Received: 12/17/2009
Spectra Project: 2009120317
Spectra Number: 1

Cal Portland - Pioneer Aggregates
4301 Pioneer Avenue
DuPont, WA 98327
Attn: Mike Skrivan

Analyte	Result	Units	Method	Analyte	Result	Units	Method
Total Solids	94.7	wt.%	SM 2540-B				
Total Arsenic	< 5	mg/Kg	SW846 6010B				
Total Cadmium	< 0.3	mg/Kg	SW846 6010B				
Total Chromium	14	mg/Kg	SW846 6010B				
Total Copper	20	mg/Kg	SW846 6010B				
Total Lead	< 4	mg/Kg	SW846 6010B				
Total Silver	< 0.7	mg/Kg	SW846 6010B				
Total Zinc	33	mg/Kg	SW846 6010B				
Total Mercury	< 0.05	mg/Kg	SW846 7471B				
PCB	<10.0	ug/Kg	SW846 8082A				
Total Organic Carbon	0.01	wt.%	SW846 9060				

* Dioxins and Furans were subcontracted to Analytical Perspectives. ** Grainsize was subcontracted to Analytical Resources, Inc. Please see complete results enclosed.

Surrogate	Recovery	Method	Surrogate	Recovery	Method
2-Fluorophenol--SIM	66	8270D--SIM	2,4,6-Tribromophenol--SIM	60	8270D--SIM
Phenol-d6--SIM	65	8270D--SIM	p-Terphenyl-d14--SIM	102	8270D--SIM
Nitrobenzene-d5--SIM	103	8270D--SIM	Decachlorobiphenyl	91	SW846 8082A
2-Fluorobiphenyl--SIM	92	8270D--SIM			

SPECTRA LABORATORIES

for

Steve Hibbs, Laboratory Manager

a14/mlh

SPECTRA Laboratories

2221 Ross Way • Tacoma, WA 98421 • (253) 272-4850 • Fax (253) 572-9838 • www.spectra-lab.com

12/28/2009

Cal Portland - Pioneer Aggregates
4301 Pioneer Ave
DuPont, WA 98327

Spectra Project #	2009120317
Sample Spiked:	Blank
Date Digested:	12/22/2009
Date Analyzed:	12/22/2009
Units:	mg/L
Applies to Spectra Sample #'s:	1

ICP Total Metals - Method 6010B
Blank Spike (LCS), Method Blank Results in Soil

Element	Spike Added	LCS Conc.	LCS %Rec	Method Blank Conc. Units: mg/Kg
Arsenic	2.0	1.948	97.4	< 5
Cadmium	2.0	1.784	89.2	< 0.3
Chromium	2.0	1.831	91.6	< 0.7
Lead	2.0	1.765	88.3	< 4
Silver	2.0	1.987	99.4	< 0.7
Copper	2.0	1.874	93.7	< 0.6
Zinc	2.0	1.770	88.5	< 0.6

* out of limits
LCS Recovery limits 80-120%
Sample Conc. of 0.000= ND

Spectra Laboratories

Steven G. Hibbs
Laboratory Manager

SPECTRA Laboratories

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12/28/2009

Cal Portland - Pioneer Aggregates
4301 Pioneer Ave
DuPont, WA 98327

Spectra Project #	2009120317
Sample Spiked:	2009120163-1
Date Spiked Sample Digested	12/22/2009
Date Digested:	12/22/2009
Date Analyzed:	12/22/2009
Units:	mg/L
Applies to Spectra #'s:	1

ICP Total Metals - Method 6010B
Matrix Spike/ Matrix Spike Duplicate Results in Soil

Element	Sample Conc.	Spike Conc.	MS Conc.	MS %Rec	MSD Conc	MSD %Rec	RPD
Arsenic	0.000	2.0	1.980	99.0	1.937	96.9	2.2
Cadmium	0.000	2.0	1.745	87.3	1.765	88.3	1.1
Chromium	0.054	2.0	2.315	113.1	2.338	114.2	1.0
Lead	0.000	2.0	1.772	88.6	1.797	89.9	1.4
Silver	0.000	2.0	2.044	102.2	2.046	102.3	0.1
Copper	0.380	2.0	2.209	91.5	2.196	90.8	0.7
Zinc	0.626	2.0	2.345	86.0	2.379	87.7	2.0

* out of limits
Recovery limits 75-125%
Sample Conc. of 0.000= ND
RPD Limit 20

Spectra Laboratories

Steven G. Hibbs
Laboratory Manager

SPECTRA Laboratories
2221 Ross Way • Tacoma, WA 98421 • (253) 272-4850 • Fax (253) 572-9838 • www.spectra-lab.com

December 29, 2009

Cal Portland - Pioneer Aggregates
Attn: Mike Skrivan
4301 Pioneer Avenue
DuPont, WA 98327

Method: EPA Method 8082
Sample Matrix: Soil
Units: ug/Kg
Spectra Project: 2009120317
Applies to Spectra # 1

PCB ANALYSIS
QUALITY CONTROL RESULTS

MS/MSD

Spiked Sample: 2009120089-21

Date Extracted: 12/14/2009
Date Analyzed: 12/14/2009

Compound	Sample Result	Spike Amount Added	Spike Amount Found	Percent Recovery	Dup. Spike Amount Found	Percent Recovery	RPD
AR1260	<10.0	25.0	26.0	104	25.8	103	1

METHOD BLANK

Date Extracted: 12/28/2009

Date Analyzed: 12/28/2009

PCB's <10.0

Surrogate Percent Recoveries:

Decachlorobiphenyl 95%

SPECTRA LABORATORIES

for

Steven G. Hibbs, Laboratory Manager

Analytical Resources, Incorporated
Analytical Chemists and Consultants

December 22, 2009

Ms. Marie Holt
Spectra Laboratories
2221 Ross Way
Tacoma, WA 98421

RE: Client Project: 2009 120317
ARI Project: QC05

Dear Ms. Holt:

The laboratory testing you requested has been completed. The following narrative describes the method and results of the grain size distribution and moisture content determination tests. Please call me to discuss any questions or comments you may have on the data or its presentation.

Best regards,

Analytical Resources, Inc.

Guenna Smith
Geotechnical Laboratory Manager
206-695-6246
guennas@arilabs.com

Enclosures

cc: Files QC05

4611 South 134th Place, Suite 100 • Tukwila WA 98168 • **206-695-6200** • **206-695-6201** fax

SPECTRA Laboratories

CHAIN of CUSTODY

2221 Ross Way • Tacoma, WA 98421 • (253) 272-4850 • Fax (253) 572-9838 • www.spectra-lab.com

PAGE 1 of 1

STANDARD ☐ RUSH ☒ *

CLIENT: Spectra Laboratories ADDRESS:

PROJECT: 2009 120 317

CONTACT: Marie Holt

PHONE: See above FAX:

e-MAIL: marieh@spectra-lab.com Prefer FAX ☐ or e-MAIL ☐

PURCHASE ORDER #:

	SAMPLE ID	DATE SAMPLED	TIME SAMPLED	MATRIX	NUMBER OF CONTAINERS	HYDROCARBONS: NWTPH-HCID	BTEX	BTEX/NWTPH-G	NWTPH-G	NWTPH-Dx	1664 SGT-HEM (TPH)	1664 HEM (O&G)	ORGANICS: 8260/624 VOA	8260 CHLOR SOLVENTS	8270/625 SEMI VOA	8270 PAH/PNA	8082/608 PCB	METALS: TOTAL METALS RCRA8	TOTAL METALS (SPECIFY)	TCLP METALS RCRA 8	TCLP METALS (SPECIFY)	OTHER: pH 9040/9045	TX/TOX 9076	TURBIDITY	FLASH POINT	BOD	SOLIDS (SPECIFY)	grain size dist.	in situ moisture content
1	1	12/17/09	10:30	Soil	1																							X	X
2																													
3																													
4																													
5																													
6																													
7																													
8																													
9																													
10																													

SPECIAL INSTRUCTIONS/COMMENTS:

* 1 week TAT, please

	SIGNATURE	PRINTED NAME	COMPANY	DATE	TIME
RELINQUISHED BY	BNicholson	BNicholson	Spectra	12/17/09	1325
RECEIVED BY		A. Volgardsen	ARI	12/18/09	1045
RELINQUISHED BY					
RECEIVED BY					

RETURN SAMPLES ☐ DISPOSE SAMPLES ☐ (Shipping Fee Applies)

Payment Terms: Net 30 days. Past due accounts subject to 1½% per month interest. Customer agrees to pay all costs of collection including reasonable attorney's fees and all other costs of collection regardless of whether suit is filed in Pierce Co., WA venue. *Spectra Analytical, Inc.*

M99CS000569M 01/06

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Client: Spectra Laboratories	**ARI Project No.:** QC05
Client Project: 2009 120317	

Case Narrative

1. One sample was submitted for grain size analysis according to Puget Sound Estuary Protocol (PSEP) methodology and moisture content determination according to ASTM D2216, on December 18, 2009.
2. The sample for grain size was run in a single batch and one sample from another job was chosen for triplicate analysis. The triplicate data is reported on the QA summary.
3. The sample did not contain the required 5 grams of fines for the pipette portion of the analysis. The analytical balance has a capacity of about 200 grams (by 0.0001 grams) and a sample that would yield 5 grams of fines could not be split and stay within the capacity of the balance.
4. The data is provided in summary tables and plots.
5. There were no other noted anomalies in this project.

Approved by: _____ Date: 12/22/09
Geotechnical Laboratory Manager

4611 South 134th Place, Suite 100 • Tukwila WA 98168 • **206-695-6200** • **206-695-6201** fax

ANALYTICAL RESOURCES INCORPORATED

GEOTECHNICAL ANALYSIS DATA SHEET
Moisture Content by Method ASTM D2216

Data Release Authorized: gs
Reported: 12/22/09
Date Received: 12/18/09
Page 1 of 1

QC Report No: QC05-Spectra Laboratories
Project: 2009 120317

Client/ ARI ID	Date Sampled	Matrix	Analysis Date	Result
Comp-1 QC05A 09-31148	12/17/09	Soil	12/21/09 07:53	5.87

Reported in Percent

Spectra Laboratories
2009 120317

Apparent Grain Size Distribution Summary
Percent Retained in Each Size Fraction

Sample No.	Gravel	Very Coarse Sand	Coarse Sand	Medium Sand	Fine Sand	Very Fine Sand	Coarse Silt	Medium Silt	Fine Silt	Very Fine Silt	Clay			Total Fines
Phi Size	> -1	-1 to 0	0 to 1	1 to 2	2 to 3	3 to 4	4 to 5	5 to 6	6 to 7	7 to 8	8 to 9	9 to 10	< 10	<4
Sieve Size (microns)	> #10 (2000)	10 to 18 (2000-1000)	18-35 (1000-500)	35-60 (500-250)	60-120 (250-125)	120-230 (125-62)	62.5-31.0	31.0-15.6	15.6-7.8	7.8-3.9	3.9-2.0	2.0-1.0	<1.0	<230 (<62)
PM56 C	3.0	3.5	4.6	6.0	10.0	16.0	21.4	15.1	6.3	2.8	1.8	2.4	7.0	56.8
	3.7	3.0	4.4	5.9	9.2	16.5	21.3	16.1	6.2	2.9	1.9	2.1	6.9	57.4
	3.0	3.1	4.2	5.8	9.9	15.8	21.6	15.5	6.6	2.8	2.0	2.4	7.2	58.1
Comp-1	23.4	27.0	21.4	15.3	8.1	3.1	NA	NA	NA	NA	NA	NA	NA	1.7

Notes to the Testing:
1. Organic matter was not removed prior to testing, thus the reported values are the "apparent" grain size distribution. See narrative for discussion of the testing.

QA SUMMARY

Client:	Spectra Laboratories	Client Project No.:	2009 120317
ARI Trip. Sample ID:	PM56 C	Batch No.:	QC05-1
		Page:	1 of 1

Relative Standard Deviation, By Phi Size

Sample ID	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
PM56 C	100.0	99.0	97.0	93.5	88.9	82.9	72.8	56.8	35.4	20.3	14.0	11.2	9.4	7.0
	100.0	98.4	96.3	93.3	89.0	83.0	73.9	57.4	36.1	20.0	13.8	10.9	9.0	6.9
	100.0	99.1	97.0	93.9	89.7	83.8	73.9	58.1	36.5	20.9	14.4	11.6	9.6	7.2
AVE	NA	98.83	96.79	93.57	89.17	83.24	73.53	57.42	35.99	20.42	14.06	11.24	9.34	7.03
STDEV	NA	0.35	0.41	0.30	0.44	0.51	0.61	0.61	0.52	0.47	0.29	0.34	0.33	0.14
%RSD	NA	0.35	0.43	0.32	0.49	0.62	0.83	1.07	1.44	2.31	2.05	3.01	3.50	2.04

The Triplicate Applies To The Following Samples

Client ID	Date Sampled	Date Extracted	Date Complete	QA Ratio (95-105)	Data Qualifiers	Pipette Portion (5.0-25.0g)
PM56 C	9/1/2009	9/3/2009	9/10/2009	99.9		17.4
	9/1/2009	9/3/2009	9/10/2009	98.7		17.4
	9/1/2009	9/3/2009	9/10/2009	100.2		17.7
Comp-1	12/17/2009	12/18/2009	12/21/2009	100.0	SS	2.5

* ARI Internal QA limits = 95-105%

Notes to the Testing:

1. Organic matter was not removed prior to testing, thus the reported values are the "apparent" grain size distribution. See narrative for discussion of the testing.

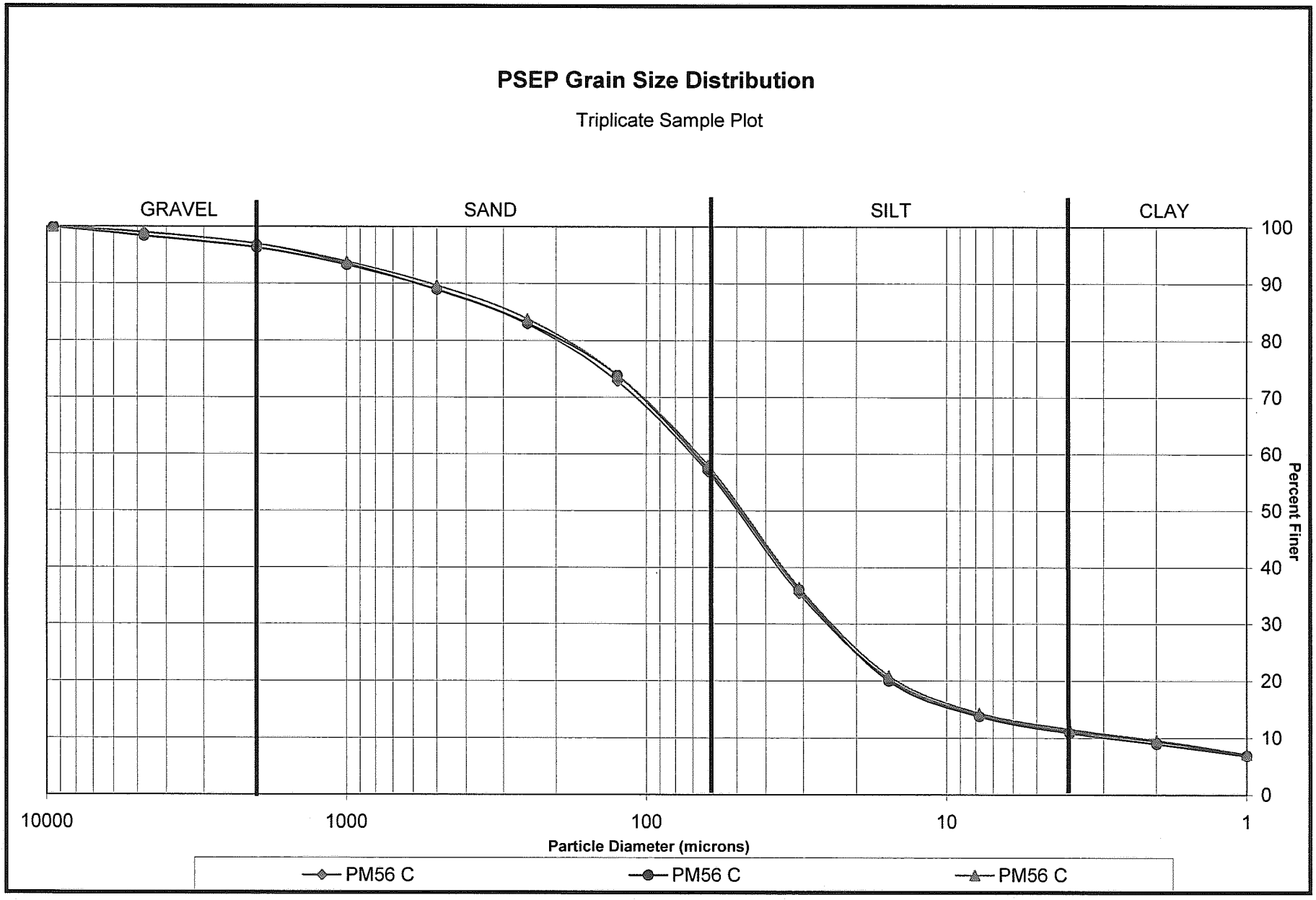
Spectra Laboratories
2009 120317

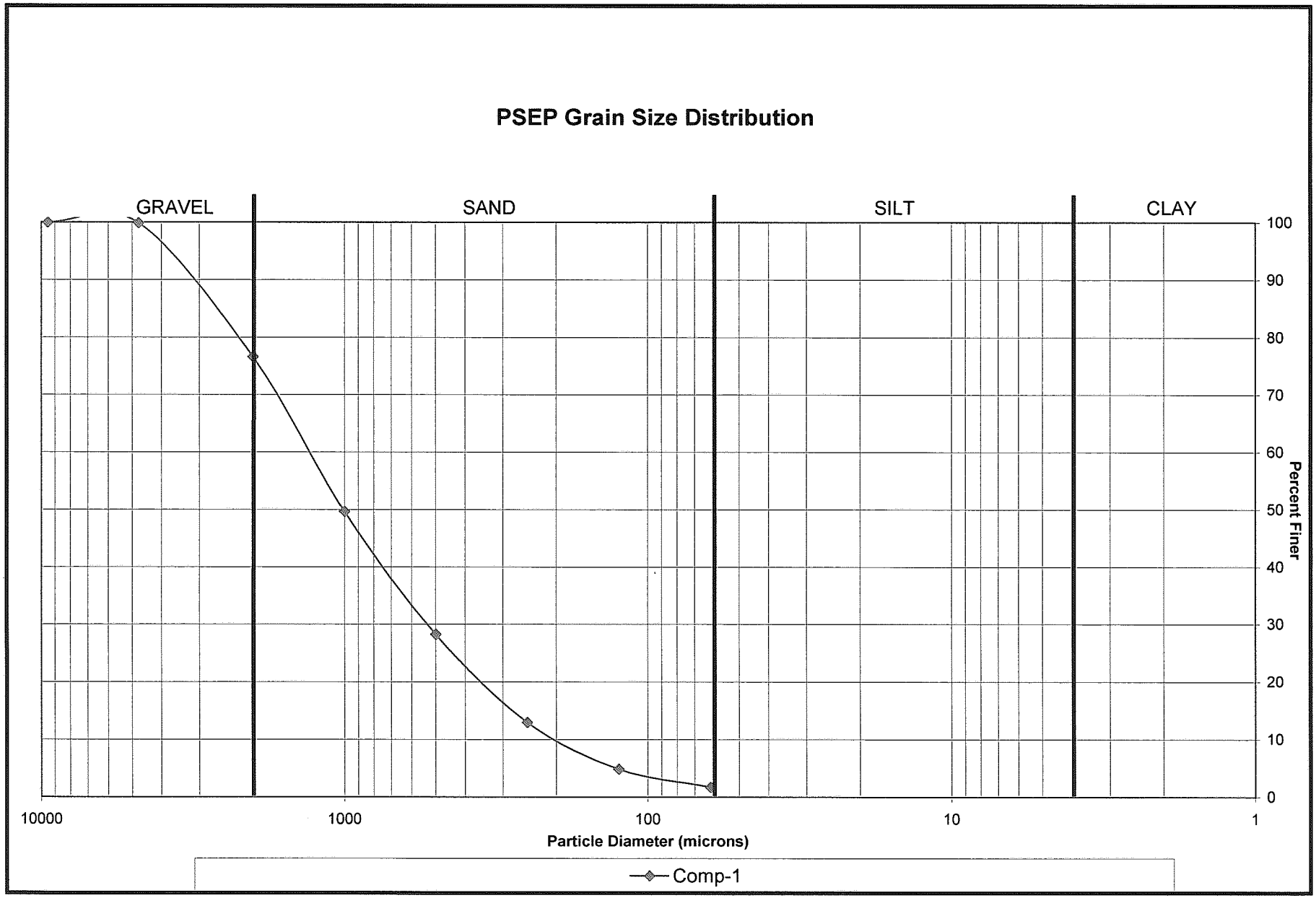
Apparent Grain Size Distribution Summary
Percent Finer Than Indicated Size

Sample No.	Gravel			Very Coarse Sand	Coarse Sand	Medium Sand	Fine Sand	Very Fine Sand	Silt				Clay	
Phi Size	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Sieve Size (microns)	3/8"	#4 (4750)	#10 (2000)	#18 (1000)	#35 (500)	#60 (250)	#120 (125)	#230 (63)	31.00	15.60	7.80	3.90	2.00	1.00
PM56 C	100.0	99.0	97.0	93.5	88.9	82.9	72.8	56.8	35.4	20.3	14.0	11.2	9.4	7.0
	100.0	98.4	96.3	93.3	89.0	83.0	73.9	57.4	36.1	20.0	13.8	10.9	9.0	6.9
	100.0	99.1	97.0	93.9	89.7	83.8	73.9	58.1	36.5	20.9	14.4	11.6	9.6	7.2
Comp-1	100.0	99.9	76.6	49.6	28.2	13.0	4.9	1.7	NA	NA	NA	NA	NA	NA

Notes to the Testing:

1. Organic matter was not removed prior to testing, thus the reported values are the "apparent" grain size distribution. See narrative for discussion of the testing.


PSEP Grain Size Distribution
Triplicate Sample Plot
GRAVEL
SAND
SILT
CLAY
100
90
80
70
60
50
40
30
20
10
0
Percent Finer
10000
1000
100
10
1
Particle Diameter (microns)
PM56 C
PM56 C
PM56 C


PSEP Grain Size Distribution
GRAVEL
SAND
SILT
CLAY
100
90
80
70
60
50
40
30
20
10
0
Percent Finer
10000
1000
100
10
1
Particle Diameter (microns)
Comp-1

Geotechnical Data

SM Sample matrix was not appropriate for the requested analysis. This normally refers to samples contaminated with an organic product that interferes with the sieving process and/or moisture content, porosity and saturation calculations

SS Sample did not contain the proportion of "fines" required to perform the pipette portion of the grain size analysis

W Weight of sample in some pipette aliquots was below the level required for accurate weighing

F Samples were frozen prior to particle size determination

22 December 2009

Marie Holt
Spectra Laboratories
2221 Ross Way
Tacoma, WA 98421

Ph.: 253-272-4850
Fax: 253-572-9838
Email: marieh@spectra-lab.com

Subject: Certificate of Results

Dear Marie;

Attached to this narrative are the analytical results you requested on samples submitted for the determination of polychlorinated dibenzo-*p*-dioxins and dibenzofurans. The insert below summarizes the relevant information pertaining to your project. In particular, QC annotations bring to your attention specific analytical observations and assessments made during the sample handling and data interpretation phases. Results reported relate only to the items tested.

Project Information Summary	When applicable, see QC Annotations for details
Client Project No.	2009120317
AP Project #	**P1919**
Analytical Protocol	Method 8290
No. Samples Submitted	1
No. Samples Analyzed	1
No. Laboratory Method Blanks	1
No. OPRs / Batch CS3	1
No. Outstanding Samples	0
Date Received	18-Dec-2009
Condition Received	good
Temperature upon Receipt (C)	9
Extraction within Holding Time	yes
Analysis within Holding Time	yes
Data meet QA/QC Requirements	yes
Exceptions	none
Analytical Difficulties	none

QC Annotations:

1. A "J" data qualifier is used for analytes with a concentration below the reporting limit.

2. The "EMPC" data qualifier is used for analytes reported as an Estimated Maximum Possible Concentration. This flag indicates that a peak is detected with an ion-abundance ratio outside the allowed theoretical range.

Analytical Perspectives remains committed to serving you in the most effective manner. Should you have any questions or need additional information and technical support, please do not hesitate to contact us. Thank you for choosing Analytical Perspectives as part of your analytical support team.

Sincerely,

Kimberly Mace, Ph.D.
Project Manager

2714 EXCHANGE DRIVE
WILMINGTON, NC 28405
PH.: 910-794-1613

P1919 - TEQ

Project ID: 2009120317

Sample Summary Part 1 (dry weight)

ANALYTICAL PERSPECTIVES

Method 8290

Analyte	0_7441_MB001 pg/g	Comp-1 pg/g
2,3,7,8-TCDD	(0.0294)	(0.0384)
1,2,3,7,8-PeCDD	(0.0385)	(0.0461)
1,2,3,4,7,8-HxCDD	(0.0538)	(0.0371)
1,2,3,6,7,8-HxCDD	(0.0529)	(0.04)
1,2,3,7,8,9-HxCDD	(0.0637)	(0.0478)
1,2,3,4,6,7,8-HpCDD	(0.048)	(0.0352)
OCDD	(0.0591)	[0.46]
2,3,7,8-TCDF	(0.02)	(0.0198)
1,2,3,7,8-PeCDF	(0.0257)	(0.032)
2,3,4,7,8-PeCDF	(0.024)	(0.0319)
1,2,3,4,7,8-HxCDF	(0.0287)	(0.019)
1,2,3,6,7,8-HxCDF	(0.0265)	(0.0167)
2,3,4,6,7,8-HxCDF	(0.0308)	(0.02)
1,2,3,7,8,9-HxCDF	(0.043)	(0.0273)
1,2,3,4,6,7,8-HpCDF	(0.0241)	(0.0247)
1,2,3,4,7,8,9-HpCDF	(0.0339)	(0.0388)
OCDF	(0.0578)	(0.0574)
ITEF TEQ (ND=0; EMPC=0)	**0.00**	**0.00**
ITEF TEQ (ND=0; EMPC=EMPC)	**0.00**	**0.00046**
ITEF TEQ (ND=DL/2; EMPC=0)	**0.0475**	**0.0514**
ITEF TEQ (ND=DL/2; EMPC=EMPC)	**0.0475**	**0.0518**
ITEF TEQ (ND=DL; EMPC=EMPC)	**0.0951**	**0.103**
Checkcode	477-495	597-951
Lab ID	MB1_7441_DF_SDS	P1919_7441_001

( ) = DL
[ ] = EMPC

Reviewer KAM
Date 22 Dec 09

P1919 - TEQ

Project ID: 2009120317

Sample Summary Part 1 (wet weight)

ANALYTICAL PERSPECTIVES

Method 8290

Analyte	0_7441_MB001 pg/g	Comp-1 pg/g
2,3,7,8-TCDD	(0.0294)	(0.0384)
1,2,3,7,8-PeCDD	(0.0385)	(0.0461)
1,2,3,4,7,8-HxCDD	(0.0538)	(0.0371)
1,2,3,6,7,8-HxCDD	(0.0529)	(0.04)
1,2,3,7,8,9-HxCDD	(0.0637)	(0.0478)
1,2,3,4,6,7,8-HpCDD	(0.048)	(0.0352)
OCDD	(0.0591)	[0.437]
2,3,7,8-TCDF	(0.02)	(0.0198)
1,2,3,7,8-PeCDF	(0.0257)	(0.032)
2,3,4,7,8-PeCDF	(0.024)	(0.0319)
1,2,3,4,7,8-HxCDF	(0.0287)	(0.019)
1,2,3,6,7,8-HxCDF	(0.0265)	(0.0167)
2,3,4,6,7,8-HxCDF	(0.0308)	(0.02)
1,2,3,7,8,9-HxCDF	(0.043)	(0.0273)
1,2,3,4,6,7,8-HpCDF	(0.0241)	(0.0247)
1,2,3,4,7,8,9-HpCDF	(0.0339)	(0.0388)
OCDF	(0.0578)	(0.0574)
ITEF TEQ (ND=0; EMPC=0)	**0**	**0**
ITEF TEQ (ND=0; EMPC=EMPC)	**0**	**0.000437**
ITEF TEQ (ND=DL/2; EMPC=0)	**0.0475**	**0.0489**
ITEF TEQ (ND=DL/2; EMPC=EMPC)	**0.0475**	**0.0493**
ITEF TEQ (ND=DL; EMPC=EMPC)	**0.0951**	**0.0981**
Checkcode	477-495	597-951
Lab ID	MB1_7441_DF_SDS	P1919_7441_001

( ) = DL
[ ] = EMPC

Reviewer .....
Date .....

P1919 - WHO-2005-TEQ

Project ID: 2009120317

Sample Summary Part 1 (dry weight)

ANALYTICAL PERSPECTIVES

Method 8290

Analyte	0_7441_MB001 pg/g	Comp-1 pg/g
2,3,7,8-TCDD	(0.0294)	(0.0384)
1,2,3,7,8-PeCDD	(0.0385)	(0.0461)
1,2,3,4,7,8-HxCDD	(0.0538)	(0.0371)
1,2,3,6,7,8-HxCDD	(0.0529)	(0.04)
1,2,3,7,8,9-HxCDD	(0.0637)	(0.0478)
1,2,3,4,6,7,8-HpCDD	(0.048)	(0.0352)
OCDD	(0.0591)	[0.46]
2,3,7,8-TCDF	(0.02)	(0.0198)
1,2,3,7,8-PeCDF	(0.0257)	(0.032)
2,3,4,7,8-PeCDF	(0.024)	(0.0319)
1,2,3,4,7,8-HxCDF	(0.0287)	(0.019)
1,2,3,6,7,8-HxCDF	(0.0265)	(0.0167)
2,3,4,6,7,8-HxCDF	(0.0308)	(0.02)
1,2,3,7,8,9-HxCDF	(0.043)	(0.0273)
1,2,3,4,6,7,8-HpCDF	(0.0241)	(0.0247)
1,2,3,4,7,8,9-HpCDF	(0.0339)	(0.0388)
OCDF	(0.0578)	(0.0574)
WHO-2005 TEQ (ND=0; EMPC=0)	**0**	**0**
WHO-2005 TEQ (ND=0; EMPC=EMPC)	**0**	**0.000138**
WHO-2005 TEQ (ND=DL/2; EMPC=0)	**0.0545**	**0.0594**
WHO-2005 TEQ (ND=DL/2; EMPC=EMPC)	**0.0545**	**0.0595**
WHO-2005 TEQ (ND=DL; EMPC=EMPC)	**0.109**	**0.119**
Checkcode	477-495	597-951
Lab ID	MB1_7441_DF_SDS	P1919_7441_001

( ) = DL
[ ] = EMPC

Reviewer .....
Date .....

P1919 - Totals

Project ID: 2009120317

Sample Summary Part 2 (dry weight)

ANALYTICAL PERSPECTIVES

Method 8290

Analyte	0_7441_MB001 pg/g	Comp-1 pg/g
Totals		
TCDDs	0	0.222
PeCDDs	0	0
HxCDDs	0	0
HpCDDs	0	0
OCDD	0	0.46
TCDFs	0	0
PeCDFs	0	0
HxCDFs	0	0
HpCDFs	0	0
OCDF	0	0
Total PCDD/Fs (ND=0; EMPC=0)	**0.00**	**0.222**
Total PCDD/Fs (ND=0; EMPC=EMPC)	**0.00**	**0.682**
Total PCDD/Fs (2378-X ND=DL; EMPC=EMPC)	**0.660**	**1.21**
Total 2378s (ND=0; EMPC=0)	**0.00**	**0.00**
Total 2378s (ND=0.5; EMPC=0)	**0.330**	**0.300**
Total 2378s (ND=1; EMPC=0)	**0.660**	**0.600**
Total 2378s (ND=0; EMPC=1)	**0.00**	**0.460**
Total 2378s (ND=0.5; EMPC=1)	**0.330**	**0.726**
Total 2378s (ND=1; EMPC=1)	**0.660**	**0.992**
Checkcode	477-495	597-951
Lab ID	MB1_7441_DF_SDS	P1919_7441_001

Total 2378s = Sum of 17 2378-substituted PCDD/PCDF congeners (SARA 313)

( ) = DL
[ ] = EMPC

Reviewer .....
Date .....

P1919 - Totals

Project ID: 2009120317

Sample Summary Part 2 (wet weight)

ANALYTICAL PERSPECTIVES

Method 8290

Analyte	0_7441_MB001 pg/g	Comp-1 pg/g
Totals		
TCDDs	0	0.211
PeCDDs	0	0
HxCDDs	0	0
HpCDDs	0	0
OCDD	0	0
TCDFs	0	0
PeCDFs	0	0
HxCDFs	0	0
HpCDFs	0	0
OCDF	0	0
Total PCDD/Fs (ND=0; EMPC=0)	**0**	**0.211**
Total PCDD/Fs (ND=0; EMPC=EMPC)	**0**	**0.648**
Total PCDD/Fs (2378-X ND=DL; EMPC=EMPC)	**0.66**	**1.15**
Total 2378s (ND=0; EMPC=0)	**0**	**0**
Total 2378s (ND=0.5; EMPC=0)	**0.33**	**0.285**
Total 2378s (ND=1; EMPC=0)	**0.66**	**0.571**
Total 2378s (ND=0; EMPC=1)	**0**	**0.437**
Total 2378s (ND=0.5; EMPC=1)	**0.33**	**0.69**
Total 2378s (ND=1; EMPC=1)	**0.66**	**0.943**
Checkcode	477-495	597-951
Lab ID	MB1_7441_DF_SDS	P1919_7441_001

Total 2378s = Sum of 17 2378-substituted PCDD/PCDF congeners (SARA 313)

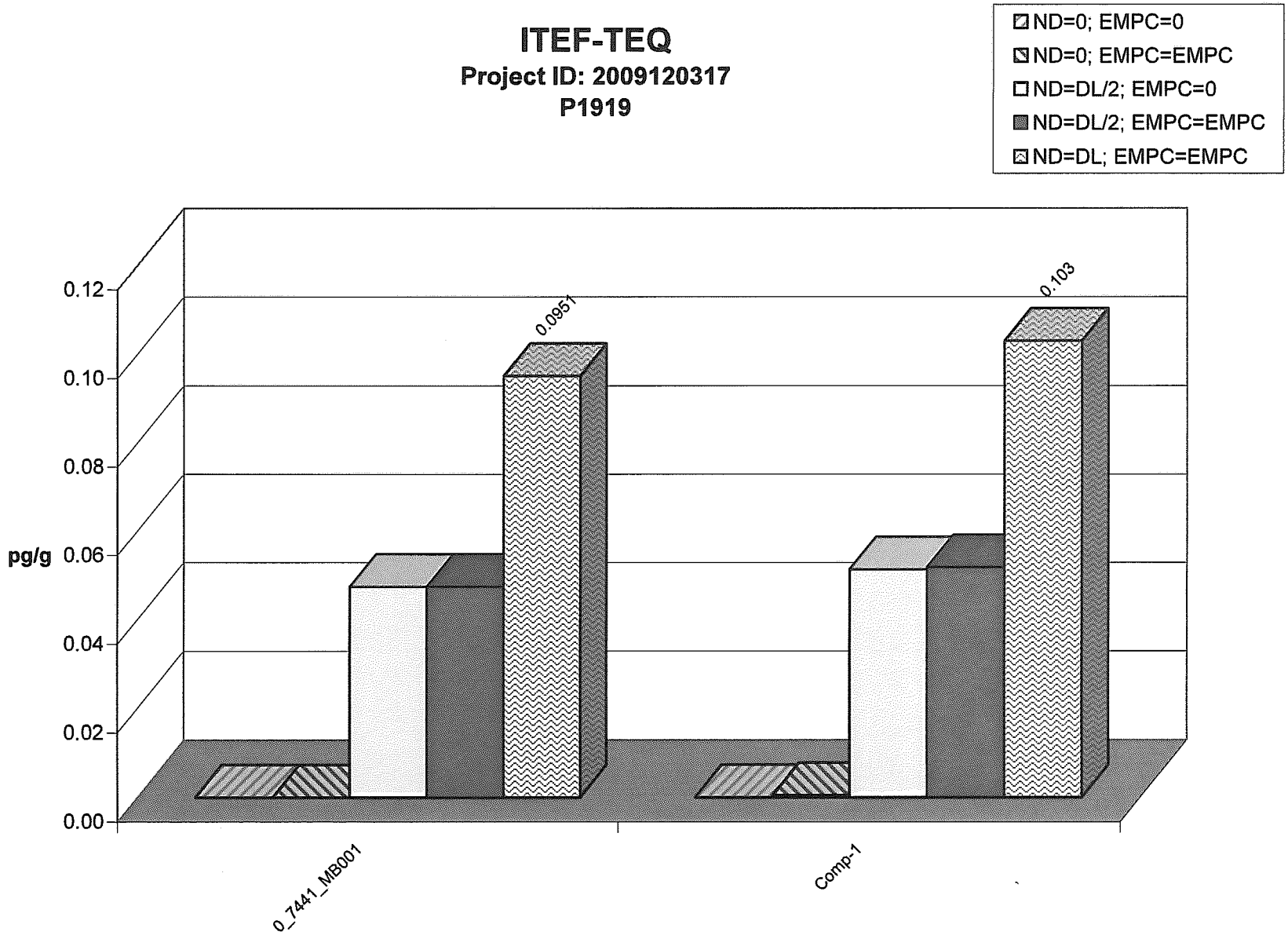
( ) = DL
[ ] = EMPC

Reviewer .....
Date .....

ITEF-TEQ

Project ID: 2009120317

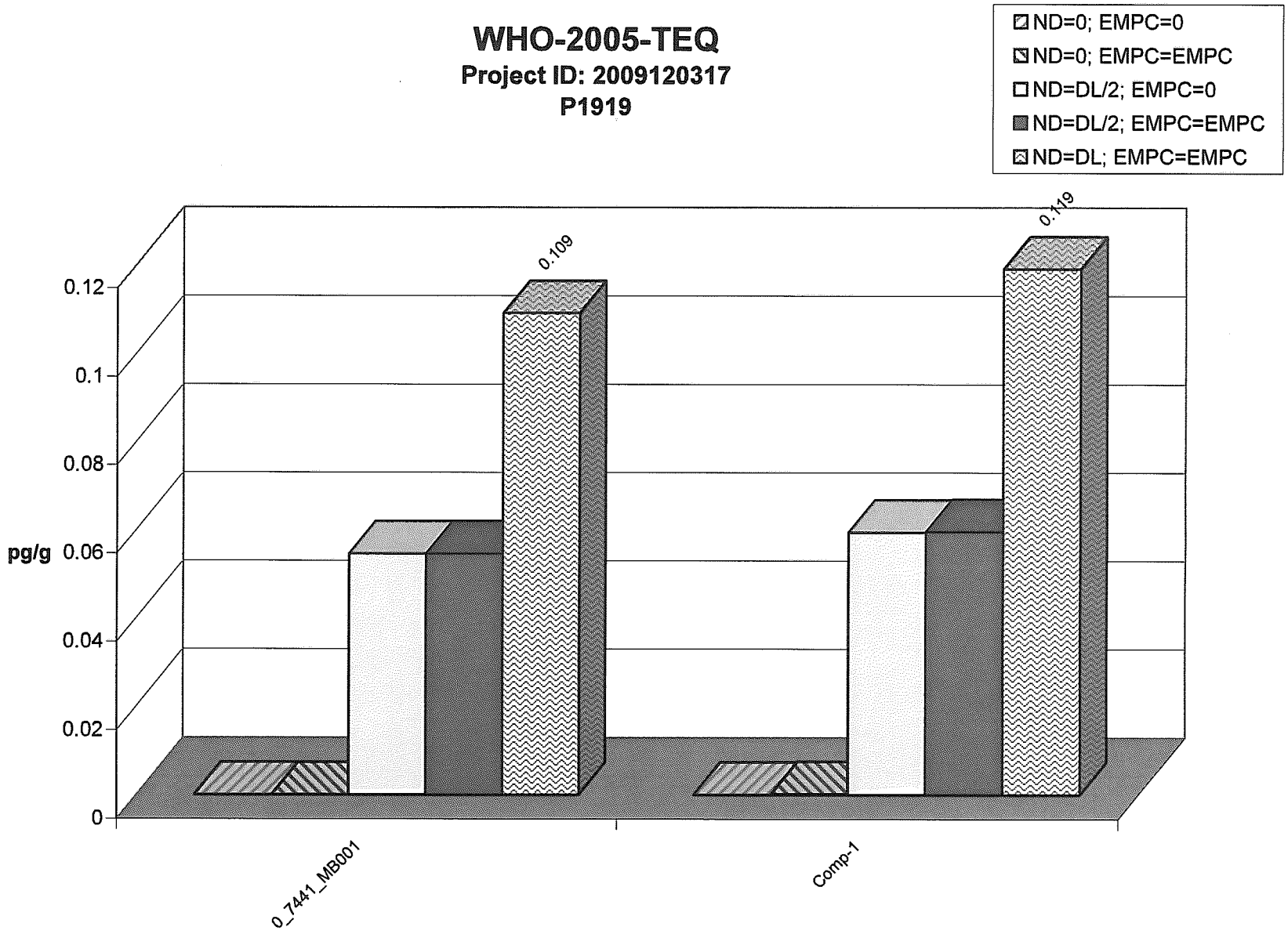
P1919



WHO-2005-TEQ

Project ID: 2009120317

P1919



P1919 - Others
Project ID: 2009120317

Sample Summary Part 3 (dry weight)	ANALYTICAL PERSPECTIVES	Method 8290
Analyte	**0_7441_MB001**	**Comp-1**
	pg/g	pg/g
Other PCDD/Fs (ND=0, EMPC=0)		
Other TCDD	0	0.222
Other PeCDD	0	0
Other HxCDD	0	0
Other HpCDD	0	0
Other TCDF	0	0
Other PeCDF	0	0
Other HxCDF	0	0
Other HpCDF	0	0
Other PCDD/Fs (ND=0, EMPC=EMPC)		
Other TCDD	0	0.222
Other PeCDD	0	0
Other HxCDD	0	0
Other HpCDD	0	0
Other TCDF	0	0
Other PeCDF	0	0
Other HxCDF	0	0
Other HpCDF	0	0
Checkcode	477-495	597-951
Lab ID	MB1_7441_DF_SDS	P1919_7441_001

( ) = DL
[ ] = EMPC

Reviewer .....
Date .....

P1919 - DLs

Project ID: 2009120317

Sample Summary
Part 5 (dry weight)

ANALYTICAL PERSPECTIVES

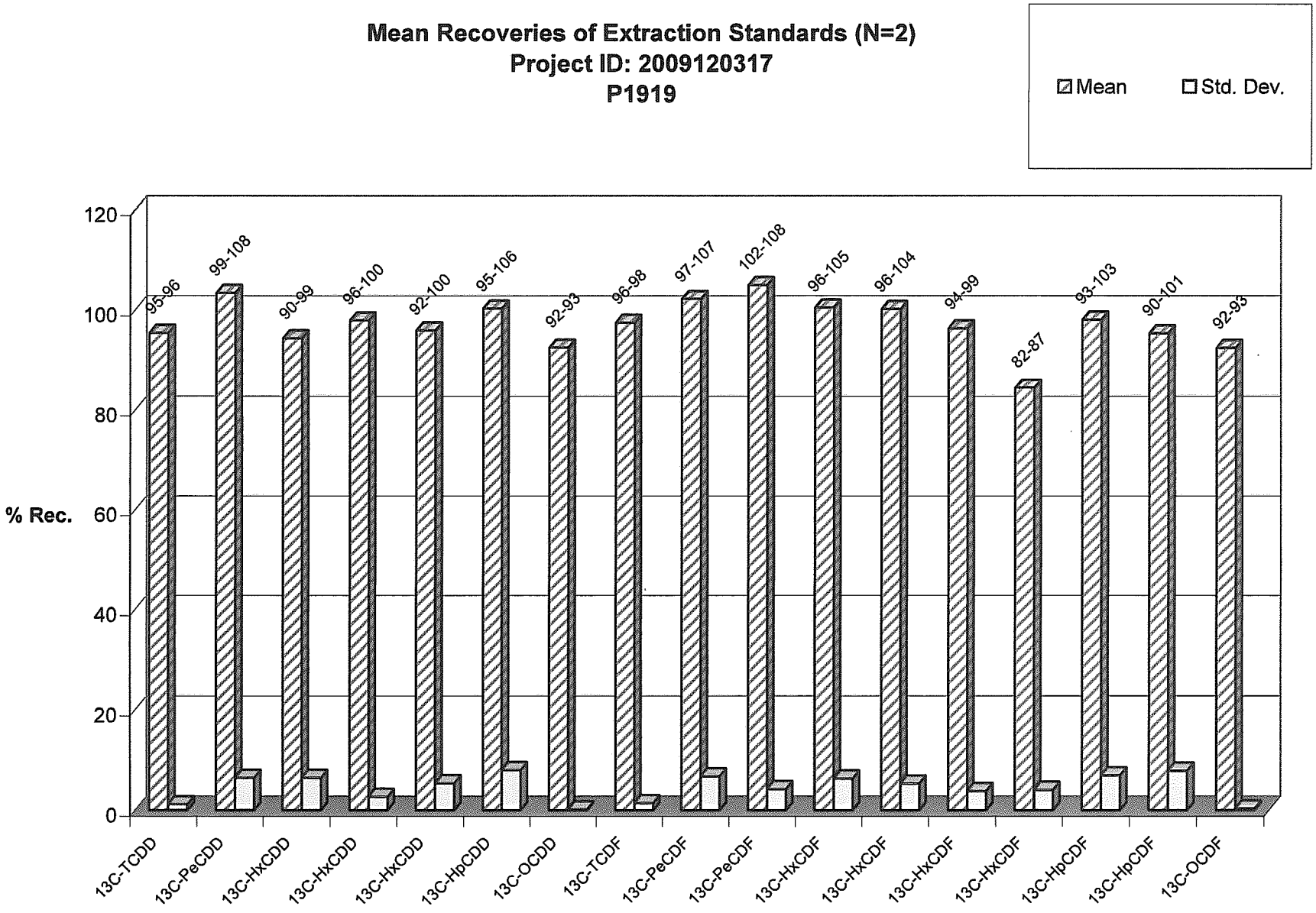
Method 8290

Analyte	0_7441_MB001	Comp-1
	pg/g	pg/g
2,3,7,8-TCDD	0.0294	0.0384
1,2,3,7,8-PeCDD	0.0385	0.0461
1,2,3,4,7,8-HxCDD	0.0538	0.0371
1,2,3,6,7,8-HxCDD	0.0529	0.04
1,2,3,7,8,9-HxCDD	0.0637	0.0478
1,2,3,4,6,7,8-HpCDD	0.048	0.0352
OCDD	0.0591	0.0682
2,3,7,8-TCDF	0.02	0.0198
1,2,3,7,8-PeCDF	0.0257	0.032
2,3,4,7,8-PeCDF	0.024	0.0319
1,2,3,4,7,8-HxCDF	0.0287	0.019
1,2,3,6,7,8-HxCDF	0.0265	0.0167
2,3,4,6,7,8-HxCDF	0.0308	0.02
1,2,3,7,8,9-HxCDF	0.043	0.0273
1,2,3,4,6,7,8-HpCDF	0.0241	0.0247
1,2,3,4,7,8,9-HpCDF	0.0339	0.0388
OCDF	0.0578	0.0574
Total TCDD	0.0294	0.0384
Total PeCDD	0.0385	0.0461
Total HxCDD	0.0564	0.0413
Total HpCDD	0.048	0.0352
Total TCDF	0.02	0.0198
Total PeCDF	0.0248	0.0319
Total HxCDF	0.0315	0.0203
Total HpCDF	0.0284	0.0309
Checkcode	477-495	597-951
Lab ID	MB1_7441_DF_SDS	P1919_7441_001

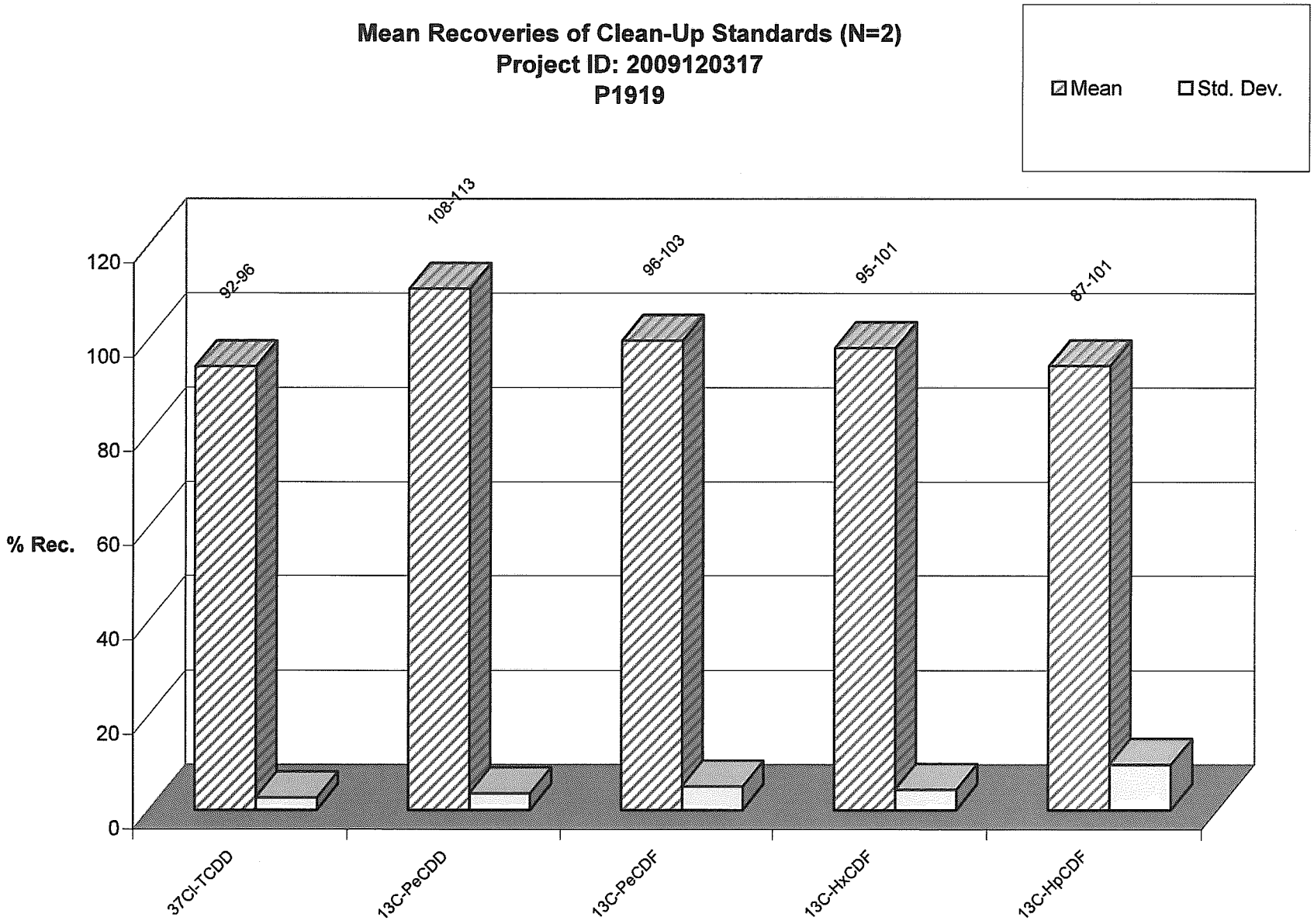
Reviewer .....

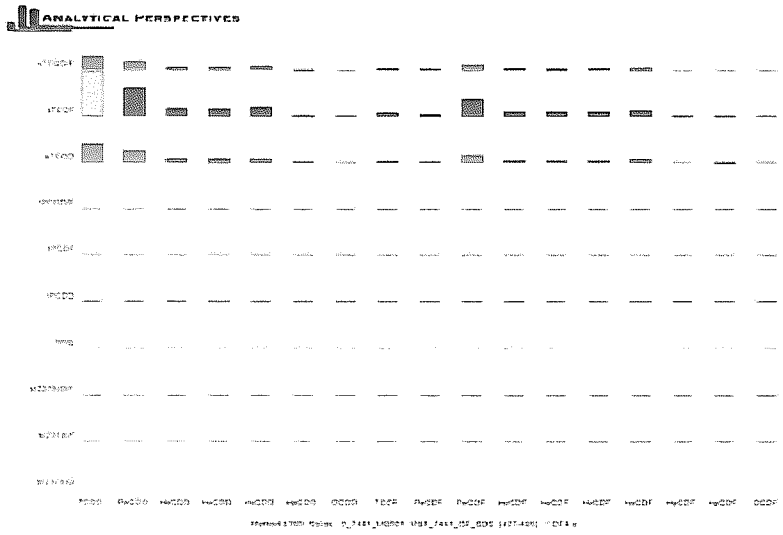
Date .....

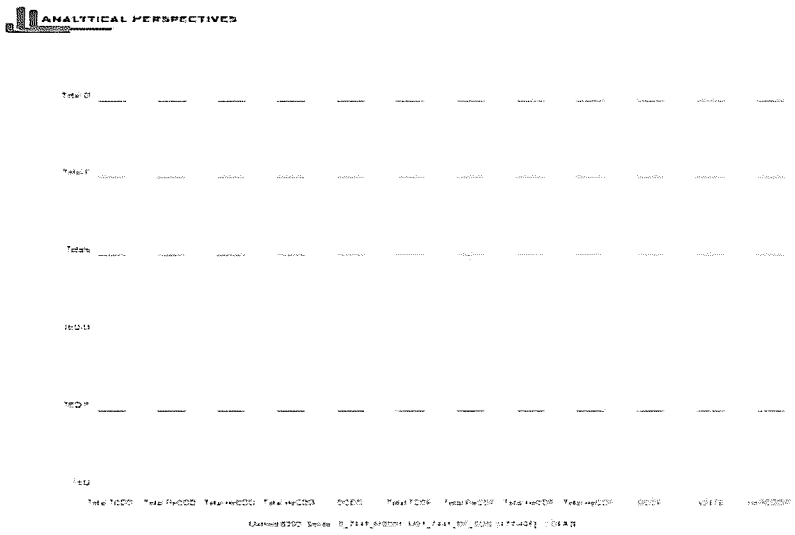
Mean Recoveries of Extraction Standards (N=2)
Project ID: 2009120317
P1919

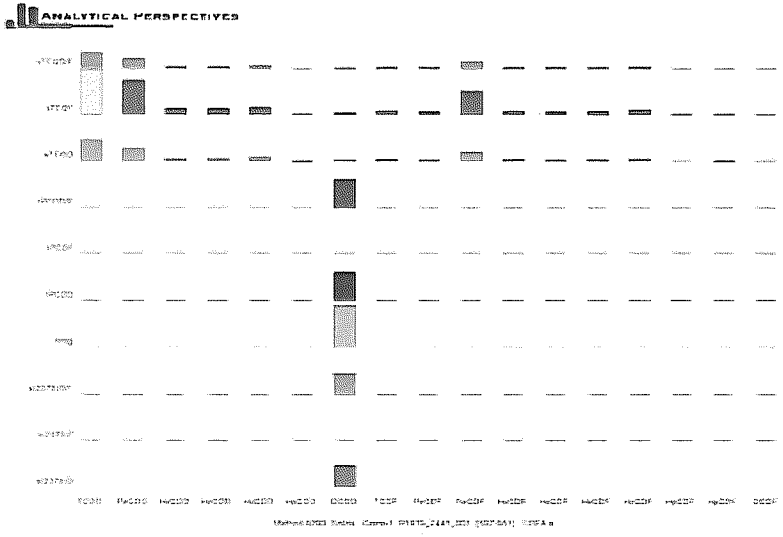


Mean Recoveries of Clean-Up Standards (N=2)
Project ID: 2009120317
P1919




ANALYTICAL PERSPECTIVES


ANALYTICAL PERSPECTIVES


ANALYTICAL PERSPECTIVES


ANALYTICAL PERSPECTIVES

Sample ID: 0_7441_MB001 — Method 8290

Client Data		Sample Data		Laboratory Data			
Name:	Spectra Laboratories	Matrix:	Solids	Lab Project ID:	P1919	Date Received:	n/a
Project ID:	2009120317	Weight/Volume:	16.00 g	Lab Sample ID	MB1_7441_DF_SDS	Date Extracted:	19 Dec 2009
Date Collected:	n/a	% Solids:	n/a	QC Batch No:	7441	Date Analyzed:	21 Dec 2009
		Split:	-	Dilution:	-	Time Analyzed:	21:30:57

Analyte	Conc. (pg/g)	DL (pg/g)	EMPC (pg/g)	Qualifiers	Standard	ES Recoveries	Qualifiers
2378-TCDD	ND	0.0294			ES 2378-TCDD	94.6	
12378-PeCDD	ND	0.0385			ES 12378-PeCDD	98.8	
123478-HxCDD	ND	0.0538			ES 123478-HxCDD	89.8	
123678-HxCDD	ND	0.0529			ES 123678-HxCDD	96	
123789-HxCDD	ND	0.0637			ES 123789-HxCDD	92.1	
1234678-HpCDD	ND	0.048			ES 1234678-HpCDD	94.6	
OCDD	ND	0.0591			ES OCDD	92.7	
2378-TCDF	ND	0.02			ES 2378-TCDF	96.4	
12378-PeCDF	ND	0.0257			ES 12378-PeCDF	97.4	
23478-PeCDF	ND	0.024			ES 23478-PeCDF	102	
123478-HxCDF	ND	0.0287			ES 123478-HxCDF	96	
123678-HxCDF	ND	0.0265			ES 123678-HxCDF	96.4	
234678-HxCDF	ND	0.0308			ES 234678-HxCDF	93.6	
123789-HxCDF	ND	0.043			ES 123789-HxCDF	81.6	
1234678-HpCDF	ND	0.0241			ES 1234678-HpCDF	93.1	
1234789-HpCDF	ND	0.0339			ES 1234789-HpCDF	89.8	
OCDF	ND	0.0578			ES OCDF	92.2	
Totals					**Standard**	**CS Recoveries**	
					CS 37Cl-2378-TCDD	92.2	
Total TCDD	ND	0.0294	ND		CS 12347-PeCDD	108	
Total PeCDD	ND	0.0385	ND		CS 12346-PeCDF	96	
Total HxCDD	ND	0.0564	ND		CS 123469-HxCDF	94.9	
Total HpCDD	ND	0.048	ND		CS 1234689-HpCDF	87.4	
Total TCDF	ND	0.02	ND				
Total PeCDF	ND	0.0248	ND				
Total HxCDF	ND	0.0315	ND				
Total HpCDF	ND	0.0284	ND				
Total PCDD/Fs	**ND**		**ND**				
ITEF TEQs							
TEQ: ND=0	0		0				
TEQ: ND=DL/2	0.0475		0.0475				
TEQ: ND=DL	0.0951		0.0951				

ANALYTICAL PERSPECTIVES
2714 Exchange Drive
Wilmington, NC 28405 , USA
info@ultratrace.com
Tel: +1 910 794-1613 (Fax: -3919); Toll-Free 866 846-8290 www.ultratrace.com

Sample ID: Comp-1

Method 8290

Client Data		Sample Data		Laboratory Data			
Name:	Spectra Laboratories	Matrix:	Solids	Lab Project ID:	P1919	Date Received:	18 Dec 2009
Project ID:	2009120317	Weight/Volume:	16.01 g	Lab Sample ID	P1919_7441_001	Date Extracted:	19 Dec 2009
Date Collected:	17 Dec 2009	% Solids:	95.1 %	QC Batch No:	7441	Date Analyzed:	21 Dec 2009
		Split:	-	Dilution:	-	Time Analyzed:	23:11:55

Analyte	Conc. (pg/g)	DL (pg/g)	EMPC (pg/g)	Qualifiers	Standard	ES Recoveries	Qualifiers
2378-TCDD	ND	0.0384			ES 2378-TCDD	96.3	
12378-PeCDD	ND	0.0461			ES 12378-PeCDD	108	
123478-HxCDD	ND	0.0371			ES 123478-HxCDD	99	
123678-HxCDD	ND	0.04			ES 123678-HxCDD	99.9	
123789-HxCDD	ND	0.0478			ES 123789-HxCDD	99.8	
1234678-HpCDD	ND	0.0352			ES 1234678-HpCDD	106	
OCDD	EMPC		0.46	J	ES OCDD	92.4	
2378-TCDF	ND	0.0198			ES 2378-TCDF	98.5	
12378-PeCDF	ND	0.032			ES 12378-PeCDF	107	
23478-PeCDF	ND	0.0319			ES 23478-PeCDF	108	
123478-HxCDF	ND	0.019			ES 123478-HxCDF	105	
123678-HxCDF	ND	0.0167			ES 123678-HxCDF	104	
234678-HxCDF	ND	0.02			ES 234678-HxCDF	99.1	
123789-HxCDF	ND	0.0273			ES 123789-HxCDF	87.4	
1234678-HpCDF	ND	0.0247			ES 1234678-HpCDF	103	
1234789-HpCDF	ND	0.0388			ES 1234789-HpCDF	101	
OCDF	ND	0.0574			ES OCDF	92.7	
Totals					**Standard**	**CS Recoveries**	
					CS 37Cl-2378-TCDD	95.9	
Total TCDD	0.222		0.222		CS 12347-PeCDD	113	
Total PeCDD	ND	0.0461	ND		CS 12346-PeCDF	103	
Total HxCDD	ND	0.0413	ND		CS 123469-HxCDF	101	
Total HpCDD	ND	0.0352	ND		CS 1234689-HpCDF	101	
Total TCDF	ND	0.0198	ND				
Total PeCDF	ND	0.0319	ND				
Total HxCDF	ND	0.0203	ND				
Total HpCDF	ND	0.0309	ND				
Total PCDD/Fs	**0.222**		**0.682**				
ITEF TEQs							
TEQ: ND=0	0		0.00046				
TEQ: ND=DL/2	0.0514		0.0518				
TEQ: ND=DL	0.103		0.103				

ANALYTICAL PERSPECTIVES
2714 Exchange Drive
Wilmington, NC 28405 , USA
info@ultratrace.com
Tel: +1 910 794-1613 (Fax: -3919); Toll-Free 866 846-8296 www.ultratrace.com

P1919 - TEQ

Project ID: 2009120317

Sample Summary Part 1 (dry weight)

ANALYTICAL PERSPECTIVES

Method 8290

Analyte	0_7441_MB001 pg/g	Comp-1 pg/g
2,3,7,8-TCDD	(0.0294)	(0.0384)
1,2,3,7,8-PeCDD	(0.0385)	(0.0461)
1,2,3,4,7,8-HxCDD	(0.0538)	(0.0371)
1,2,3,6,7,8-HxCDD	(0.0529)	(0.04)
1,2,3,7,8,9-HxCDD	(0.0637)	(0.0478)
1,2,3,4,6,7,8-HpCDD	(0.048)	(0.0352)
OCDD	(0.0591)	[0.46]
2,3,7,8-TCDF	(0.02)	(0.0198)
1,2,3,7,8-PeCDF	(0.0257)	(0.032)
2,3,4,7,8-PeCDF	(0.024)	(0.0319)
1,2,3,4,7,8-HxCDF	(0.0287)	(0.019)
1,2,3,6,7,8-HxCDF	(0.0265)	(0.0167)
2,3,4,6,7,8-HxCDF	(0.0308)	(0.02)
1,2,3,7,8,9-HxCDF	(0.043)	(0.0273)
1,2,3,4,6,7,8-HpCDF	(0.0241)	(0.0247)
1,2,3,4,7,8,9-HpCDF	(0.0339)	(0.0388)
OCDF	(0.0578)	(0.0574)
ITEF TEQ (ND=0; EMPC=0)	**0.00**	**0.00**
ITEF TEQ (ND=0; EMPC=EMPC)	**0.00**	**0.00046**
ITEF TEQ (ND=DL/2; EMPC=0)	**0.0475**	**0.0514**
ITEF TEQ (ND=DL/2; EMPC=EMPC)	**0.0475**	**0.0518**
ITEF TEQ (ND=DL; EMPC=EMPC)	**0.0951**	**0.103**
Checkcode	477-495	597-951
Lab ID	MB1_7441_DF_SDS	P1919_7441_001

( ) = DL
[ ] = EMPC

Reviewer .....
Date .....

SPECTRA Laboratories

2009120317

2221 Ross Way • Tacoma, WA 98421 • (253) 272-4850 • Fax (253) 572-9838 • www.spectra-lab.com

CHAIN of CUSTODY

PAGE 1 of 1

STANDARD ☐ RUSH ☒

CLIENT: CALPORTLAND ADDRESS:

PROJECT: TERMINAL #12

CONTACT: MIKE SKRIVAN

PHONE: 253-380-3720 FAX: 253-912-3510

e-MAIL: MSKRIVAN@CALPORTLAND.COM Prefer FAX ☐ or e-MAIL ☐

PURCHASE ORDER #:

	SAMPLE ID	DATE SAMPLED	TIME SAMPLED	MATRIX	NUMBER OF CONTAINERS	HYDROCARBONS: NWTPH-HCID	BTEX	BTEX/NWTPH-G	NWTPH-G	NWTPH-D_x	1664 SGT-HEM (TPH)	1664 HEM (O&G)		ORGANICS: 8260/624 VOA	8260 CHLOR SOLVENTS	8270/625 SEMI VOA	8270 PAH/PNA	8082/608 PCB		METALS: TOTAL METALS RCRA8	TOTAL METALS (SPECIFY)	TCLP METALS RCRA 8	TCLP METALS (SPECIFY)		OTHER: pH 9040/9045	TX/TOX 9076	TURBIDITY	FLASH POINT	BOD	SOLIDS (SPECIFY)	total organic carbon by PSEP	grain size	in situ moisture	Dioxin/Furans by 8290		
1	COMP-1	12/17/09	1030	SOIL	4											X	X	X		X											X	X	X	X		
2																																				
3																																				
4																																				
5																																				
6																																				
7																																				
8																																				
9																																				
10																																				

SPECIAL INSTRUCTIONS/COMMENTS:

	SIGNATURE	PRINTED NAME	COMPANY	DATE	TIME
RELINQUISHED BY		AMY TICE	ASPECT	12/17/09	1047
RECEIVED BY		MIKE SKRIVAN	CALPORTLAND	12-17-09	10:48
RELINQUISHED BY		MIKE SKRIVAN	CALPORTLAND	12-17-09	11:51
RECEIVED BY		K BECK	SPECTRA	12/17/09	11:52

RETURN SAMPLES ☐ DISPOSE SAMPLES ☐

(Shipping Fee Applies)

Payment Terms: Net 30 days. Past due accounts subject to 1½% per month interest. Customer agrees to pay all costs of collection including reasonable attorney's fees and all other costs of collection regardless of whether suit is filed in Pierce Co., WA venue. *Spectra Analytical, Inc.*

Appendix J

Post-placement Sand Cover Comparison to DMMP and SMS Criteria

Appendix J
Table J-1

Conventional Parameters and Grain Size	Screening Level (µg/kg dry weight)	Bioaccu-multion Trigger (µg/kg dry weight)	Maximum Level (µg/kg dry weight)	LAET (µg/kg DW)	2AET (µg/kg DW)	SG01A 3/10/2010 9:10			SG02A 3/10/2010 10:11			SG03A 3/10/2010 11:06			SG04A 3/10/2010 13:27		
						Result	Unit (dry weight)	Validation Qualifier	Result	Unit (dry weight)	Validation Qualifier	Result	Unit (dry weight)	Validation Qualifier	Result	Unit (dry weight)	Validation Qualifier
Solids, Total						86.3	percent		86.7	percent		86.2	percent		91.8	percent	
Carbon, Total Organic (TOC)						0.068	percent		0.091	percent		0.185	percent		0.067	percent	
Gravel						10.3	percent		19.8	percent		12.4	percent		29.7	percent	
Sand, Very Coarse						9.85	percent		19.35	percent		14.75	percent		24.7	percent	
Sand, Coarse						19.4	percent		10.355	percent		21.4	percent		21.7	percent	
Sand, Medium						26.3	percent		1.23	percent		23.5	percent		12	percent	
Sand, Fine						22.5	percent		16.35	percent		17.2	percent		6.68	percent	
Sand, Very Fine						6.28	percent		19.65	percent		4.615	percent		2.08	percent	
Silt						2.17	percent		11.26	percent		2.575	percent		1.76	percent	
Clay						0.88	percent		1.775	percent		1.251	percent		0.75	percent	
Low Molecular Weight Polycyclic Aromatic Hydrocarbons																	
LPAH				5200	13000	2.9	µg/kg	U	27.1	µg/kg		11	µg/kg		1.6	µg/kg	
Naphthalene	2100	—	2400	2100	2400	2.9	µg/kg	U	2.9	µg/kg	U	2.9	µg/kg	U	2.8	µg/kg	U
Acenaphthylene	560	—	1300	1300	1300	2.9	µg/kg	U	2.9	µg/kg	U	2.9	µg/kg	U	2.8	µg/kg	U
Acenaphthene	500	—	2000	500.00	730	2.9	µg/kg	U	2.9	µg/kg	U	1.5	µg/kg	J	2.8	µg/kg	U
Fluorene	540	—	3600	540	1000.0	2.9	µg/kg	U	2.1	µg/kg	J	1.6	µg/kg	J	2.8	µg/kg	U
Phenanthrene	1500	—	21000	1500	5400	2.9	µg/kg	U	10	µg/kg		5	µg/kg		1.6	µg/kg	J
Anthracene	960	—	13000	960	4400	2.9	µg/kg	U	15	µg/kg		2.9	µg/kg		2.8	µg/kg	U
2-Methylnaphthalene	670	—	1900	670	1400	2.9	µg/kg	U	2.9	µg/kg	U	2.9	µg/kg	U	2.8	µg/kg	U
High Molecular Weight Polycyclic Aromatic Hydrocarbons																	
HPAH	12000	4600	69000	12000	17000	21.8	µg/kg		480.7	µg/kg		82.7	µg/kg		18.1	µg/kg	
Fluoranthene	1700	11980	30000	1700	2500	3.7	µg/kg		210	µg/kg		14.1	µg/kg		3.7	µg/kg	
Pyrene	2600	—	16000	2600	3300	4.3	µg/kg		61	µg/kg		20.1	µg/kg		4.5	µg/kg	
Benz(a)anthracene	1300	—	5100	1300	1600	2.9	µg/kg	U	57	µg/kg		5.9	µg/kg		1.8	µg/kg	J
Chrysene	1400	—	21000	1400	2800	3.1	µg/kg		72	µg/kg		9.4	µg/kg		2.8	µg/kg	
Benzo(b)fluoranthene						3.5	µg/kg		38	µg/kg		11.1	µg/kg		3.4	µg/kg	
Benzo(k)fluoranthene						2.9	µg/kg	U	13	µg/kg		6.8	µg/kg		2.8	µg/kg	U
Total Benzofluoranthenes	3200		9900	3200	3600	3.5	µg/kg		51	µg/kg		17.9	µg/kg		3.4	µg/kg	
Benzo(a)pyrene	1600		3600	1600	3000.0	2.1	µg/kg	J	18	µg/kg		6.2	µg/kg		1.9	µg/kg	J
Indeno(1,2,3-cd)pyrene	600		4400	600	690	2.9	µg/kg	U	6.4	µg/kg		3.8	µg/kg		2.8	µg/kg	U
Dibenz(a,h)anthracene	230		1900	230	540	2.9	µg/kg	U	2.1	µg/kg	J	1.7	µg/kg	J	2.8	µg/kg	U
Benzo(g,h,i)perylene	670		3200	670	720	1.6	µg/kg	J	3.2	µg/kg		3.6	µg/kg		2.8	µg/kg	U
Chlorinated Organics																	
1,2-Dichlorobenzene	35		110	35	50.000	5.8	µg/kg	U	5.8	µg/kg	U	5.8	µg/kg	U	5.5	µg/kg	U
1,3-Dichlorobenzene	170					5.8	µg/kg	U	5.8	µg/kg	U	5.8	µg/kg	U	5.5	µg/kg	U
1,4-Dichlorobenzene	110		120	110	120	5.8	µg/kg	U	5.8	µg/kg	U	5.8	µg/kg	U	5.5	µg/kg	U
1,2,4-Trichlorobenzene	31		64	31	51	5.8	µg/kg	U	5.8	µg/kg	U	5.8	µg/kg	U	5.5	µg/kg	U
Hexachlorobenzene	22	168	230	22	70.000	5.8	µg/kg	U	5.8	µg/kg	U	5.8	µg/kg	U	5.5	µg/kg	U
Phthalate Esters																	
Dimethyl Phthalate	71		1400	71	160	5.8	µg/kg	U	5.8	µg/kg	U	5.8	µg/kg	U	5.5	µg/kg	U
Diethyl Phthalate	200		1200	200	1200	5.8	µg/kg	U	5.8	µg/kg	U	5.8	µg/kg	U	5.5	µg/kg	U
Di-n-butyl Phthalate	1400		5100	1400	5100	12	µg/kg	U	12	µg/kg	U	12	µg/kg	U	11	µg/kg	U
Butyl Benzyl Phthalate	63		970	63	900	5.8	µg/kg	U	5.8	µg/kg	U	5.8	µg/kg	U	5.5	µg/kg	U
Bis(2-ethylhexyl) Phthalate	1300		8300	1300	3100	8.4	µg/kg	J	58	µg/kg	U	33.3	µg/kg		8.2	µg/kg	J
Di-n-octyl Phthalate	6200		6200	6200	6200	5.8	µg/kg	U	5.8	µg/kg	U	5.8	µg/kg	U	5.5	µg/kg	U

Appendix J
Table J-1

Conventional Parameters and Grain Size	Screening Level (µg/kg dry weight)	Bioaccu-multion Trigger (µg/kg dry weight)	Maximum Level (µg/kg dry weight)	LAET (µg/kg DW)	2AET (µg/kg DW)	SG01A 3/10/2010 9:10			SG02A 3/10/2010 10:11			SG03A 3/10/2010 11:06			SG04A 3/10/2010 13:27		
						Result	Unit (dry weight)	Validation Qualifier	Result	Unit (dry weight)	Validation Qualifier	Result	Unit (dry weight)	Validation Qualifier	Result	Unit (dry weight)	Validation Qualifier
Dibenzofuran	540		1700	540	700.00	5.8	µg/kg	U	5.8	µg/kg	U	1.4	µg/kg	J	5.5	µg/kg	U
Hexachlorobutadiene				11	120	5.8	µg/kg	U	5.8	µg/kg	U	5.8	µg/kg	U	5.5	µg/kg	U
N-Nitrosodiphenylamine	28		130	28	40.000	5.8	µg/kg	U	5.8	µg/kg	U	5.8	µg/kg	U	5.5	µg/kg	U
Phenol	420		1200	420	1200	18	µg/kg	U	18	µg/kg	U	18	µg/kg	U	17	µg/kg	U
2-Methylphenol	63		77	63	72	5.8	µg/kg	U	5.8	µg/kg	U	5.8	µg/kg	U	5.5	µg/kg	U
4-Methylphenol	670		3600	670	1800	5.8	µg/kg	U	5.8	µg/kg	U	5.8	µg/kg	U	5.5	µg/kg	U
2,4-Dimethylphenol	29		210	29	72	29	µg/kg	U	29	µg/kg	U	29	µg/kg	U	28	µg/kg	U
Pentachlorophenol (PCP)	400	504	690	360	690	58	µg/kg	U	58	µg/kg	U	58	µg/kg	U	55	µg/kg	U
Benzyl Alcohol	57		870	57	73	12	µg/kg	U	12	µg/kg	U	12	µg/kg	U	11	µg/kg	U
Benzoic Acid	650		760	650	65	120	µg/kg	U	120	µg/kg	U	120	µg/kg	U	110	µg/kg	U
Hexachloroethane	1400		14000			5.8	µg/kg	U	5.8	µg/kg	U	5.8	µg/kg	U	5.5	µg/kg	U
Dioxins																	
Total Dioxin and Chlorinated Furan TEQ	4 TEQ		10 TEQ Volume averaged to 4 TEQ)			0.1374869			0.11501			0.6043884			0.4738		
Total Dioxin and Chlorinated Furan TEQ using 1/2 RL						4.5554869			5.109055			1.8954384			1.891015		
Total Dioxin TEQ						0.0505			0.06431			0.4842			0.385		
Total Dioxin TEQ using 1/2 RL						3.4549			3.47736			1.0842			0.89		
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)						1.13	ng/Kg	U	1.13	ng/Kg	U	1.2	ng/Kg	U	1.01	ng/Kg	U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)						5.63	ng/Kg	U	5.64	ng/Kg	U	0.0908	ng/Kg	J	0.101	ng/Kg	J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)						0.0394	ng/Kg	J	0.0392	ng/Kg	J	0.147	ng/Kg	J	0.057	ng/Kg	
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)						0.171	ng/Kg		0.239	ng/Kg	J	0.506	ng/Kg	J	0.521	ng/Kg	J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)						0.159	ng/Kg	J	0.169	ng/Kg		0.502	ng/Kg	J	0.398	ng/Kg	J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)						4.88	ng/Kg	U	5.61	ng/Kg	U	21.7	ng/Kg		11.5	ng/Kg	
Octachlorodibenzo-p-dioxin (OCDD)						45.2	ng/Kg		65.3	ng/Kg	J	203	ng/Kg		238	ng/Kg	
Chlorinated Furans																	
Total Chlorinated Furan TEQ						0.0869869			0.0507			0.1201884			0.0888		
Total Chlorinated Furan TEQ using 1/2 RL						1.1005869			1.631695			0.8112384			1.001015		
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)						0.0642	ng/Kg		5.64	ng/Kg	U	0.0819	ng/Kg	J	5.06	ng/Kg	U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)						5.63	ng/Kg	U	5.64	ng/Kg	U	0.122	ng/Kg	J	5.06	ng/Kg	U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)						0.244	ng/Kg	J	0.169	ng/Kg	J	0.277	ng/Kg	J	0.198	ng/Kg	J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)						0.073	ng/Kg		5.64	ng/Kg	U	0.104	ng/Kg	J	0.176	ng/Kg	J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)						5.63	ng/Kg	U	5.64	ng/Kg	U	6.01	ng/Kg	U	5.06	ng/Kg	U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)						5.63	ng/Kg	U	5.64	ng/Kg	U	0.148	ng/Kg	J	0.118	ng/Kg	J
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)						5.63	ng/Kg	U	5.64	ng/Kg	U	6.01	ng/Kg	U	5.06	ng/Kg	U
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)						5.63	ng/Kg	U	5.64	ng/Kg	U	6.01	ng/Kg	U	5.06	ng/Kg	U
Octachlorodibenzofuran (OCDF)						11.3	ng/Kg	U	11.3	ng/Kg	U	12	ng/Kg	U	10.1	ng/Kg	U
Tetrachlorodibenzo-p-dioxins (TCDD), Total						0.223	ng/Kg	J	1.13	ng/Kg	U	0.128	ng/Kg	J	1.01	ng/Kg	U
Pentachlorodibenzo-p-dioxin (PeCDD), Total						5.63	ng/Kg	U	5.64	ng/Kg	U	0.0908	ng/Kg	J	0.101	ng/Kg	J
Hexachlorodibenzo-p-dioxins (HxCDD), Total						1.3	ng/Kg	J	1.87	ng/Kg	J	4.17	ng/Kg		3.19	ng/Kg	J
Heptachlorodibenzo-p-dioxins (HpCDD), Total						13.7	ng/Kg		17.1	ng/Kg		44.1	ng/Kg		25.7	ng/Kg	
Tetrachlorodibenzofurans (TCDF), Total						0.901	ng/Kg	J	1.48	ng/Kg		0.613	ng/Kg	J	0.473	ng/Kg	J
Pentachlorodibenzofurans (PeCDF), Total						0.173	ng/Kg	J	0.372	ng/Kg	J	0.774	ng/Kg	J	0.485	ng/Kg	J
Hexachlorodibenzofurans (HxCDF), Total						1.28	ng/Kg	J	0.731	ng/Kg	J	2.584	ng/Kg	J	2.74	ng/Kg	J
Heptachlorodibenzofurans (HpCDF), Total						2.78	ng/Kg	J	3.16	ng/Kg	J	6.725	ng/Kg		6.09	ng/Kg	

Notes:
J - The analyte was detected above the reported quantitation limit, and the reported concentration was an estimated value.
U - The analyte was analyzed for, but was considered not detected at the reporting limit or reported value.

Appendix K

Sand Cover Validation Report

Data Validation Report

Port of Seattle Terminal 115 Sand Cover Monitoring
March 2010 Sampling

Prepared for:

Science and Engineering for the Environment, LLC.
4401 Latona Ave NE
Seattle, WA 98105

Prepared by:

Pyron Environmental, Inc.
3530 32nd Way NW
Olympia, WA 98502

May 8, 2010

ACRONYMS

%D	percent difference
%D_f	percent drift
%R	percent recovery
%RSD	percent relative standard deviation
CDD	chlorinated dibenzo-p-dioxin
CDF	chlorinated dibenzofuran
CF	calibration factor
CLP	U.S. EPA Contract Laboratory Program
COC	chain-of-custody
DFTPP	decafluorotriphenylphosphine
EMPC	estimated maximum possible concentration
EPA	U.S. Environmental Protection Agency
GC/MS	gas chromatograph/mass spectrometer
HRGC	high-resolution gas chromatograph
HRMS	high-resolution mass spectrometer
ICAL	initial calibration
IPR	initial precision and recovery
ISC	isomer specificity check
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
mg/kg	milligram per kilogram
µg/kg	microgram per kilogram
MDL	method detection limit
MS	matrix spike
MSD	matrix spike duplicate
m/z	mass-to-charge ratio
ng/kg	nanogram per kilogram
NFGs	CLP National Functional Guidelines for Data Review (EPA 2008 – Organics, EPA 2005 - Dioxins and Furans)
OPR	ongoing precision and recovery
PCDD	polychlorinated dibenzo-p-dioxin
PCDF	polychlorinated dibenzofuran
PEM	performance evaluation mixture

QAPP	quality assurance project plan
QA/QC	quality assurance/quality control
RF	response factor
RL	reporting limit
RPD	relative percent difference
SDG	sample delivery group
SICP	selected ion current profile
S/N	signal-to-noise ratio
SVOCs	semi-volatile organic compounds
WDM	window defining mixture

INTRODUCTION

This report presents and discusses findings of the data validation performed on analytical data for samples collected during March 2010 for the referenced project. The laboratory report validated herein was submitted by Columbia Analytical Services, Inc. in one sample delivery group (SDG) – K1002316.

A level IV data validation was performed. The validation followed the procedures specified in USEPA CLP National Functional Guidelines ([NFGs], EPA 2008 – Organics, EPA 2005 – Chlorinated Dioxin/Furans), with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with those specified in the Sand Cover Monitoring Plan ([*Plan*], Anchor, June 2009) and the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the respective analytical methods.

Validation findings are discussed for each QC parameter pertinent to each type of analyses evaluated. Qualified data with applied data qualifiers are summarized in the **Summary** section at the end of this report. As part of the level IV validation, 10 percent of the initial calibrations, calibration verifications, laboratory QC analyses, and sample results were verified via re-calculation checks.

Samples and the associated analyses validated herein are summarized as follows:

Field Sample ID	Laboratory Sample ID	Sampling Date	Matrix	Analysis		
				TOC Grain Size	SVOCs	Dioxins/Furans
T115SG01A100310	K1002316-001	3/10/2010	Sediment	X	X	X
T115SG02A100310	K1002316-004	3/10/2010	Sediment	X	X	X
T115SG03A100310	K1002316-007	3/10/2010	Sediment	X	X	X
T115SG04A100310	K1002316-010	3/10/2010	Sediment	X	X	X
T115SG51A100310	K1002316-013	3/10/2010	Sediment	X	X	X

Notes:
X - The analysis was requested and performed on the sample
TOC- Total organic carbon
SVOCs – Semi-volatile organic compounds, analyte list specified in the QAPP
PCBs – Polychlorinated biphenyls (Aroclors only)
Dioxins/Furans – Polychlorinated dioxins & furans

Analytical methods in respect to analytical parameters validated herein and the laboratory performing the analyses are summarized below:

Parameter	Analytical Method	Laboratory
TOC	Plumb, 1981	Columbia Analytical Services, Inc. (CAS), Kelso, Washington
Grain Size	PSEP Protocols	
PCB Aroclors	SW846 Method 8082	
SVOCs	SW846 Method 8270C	
Polychlorinated Dioxins & Furans	EPA Method 1613B	Columbia Analytical Services, Inc. (CAS), Houston, Texas

Notes:

1. SW846 Methods - *USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,* SW-846, Third Edition, December 1996 and Updates.
2. *USEPA Method 1613 Tetra- Through Octa-Chlorinated Dioxins and Furans by Isotope Dilution HRGC/HRMS,* October 1994.
3. PSEP Protocols - *PSEP Recommended Protocols for Measuring Conventional Sediment Variables in Puget Sound,* Puget Sound Water Quality Authority, March 1986.
4. Plumb 1981 - *Procedures for Handling and Chemical Analysis of Sediment and Water Samples.* Technical Report, EPA/CE-B1-1. U.S. Army Corps of Engineers. Plumb, R.H. 1981.

DATA VALIDATION FINDINGS

1. Semi-volatile Organic Compounds (SVOCs) by GC/MS (SW846 Method 8270C)

1.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. All samples were extracted and analyzed within the required holding times.

1.2 GC/MS Instrument Performance Check

DFTPP tuning was performed within each 12-hour interval. All required ion abundance ratios met the method requirements.

1.3 Initial Calibration

The NFGs criteria require that the average response factor (RF) be ≥0.05 for all analytes and surrogate compounds.

The method linearity criteria require that (1) if linear average RFs is chosen as the quantitation option, the %RSD of RFs be ≤15% for the analyte, (2) if least-square linear regression is chosen for quantitation, the correlation coefficient (r) be ≥0.99, and (3) if six-point non-linear (quadratic) curve is chosen for quantitation, the coefficient of determination (r^2) be ≥0.99.

1.4 Calibration Verification

The NFGs criteria require that (1) continuing calibrations be analyzed at the beginning of each 12-hour analysis period prior to the analysis of method blank and samples, (2) the percent difference (%D) be within ±20%, and (3) the RF be ≥0.05 for all analytes and surrogate compounds.

Calibration verifications were performed at the required frequency, and all %D values met the method criterion or the outliers had no effects on data quality (*e.g.,* high bias recovery where the compound was not detected in associated samples).

1.5 Method Blanks

Method blanks were prepared and analyzed as required. No target analytes were detected at or above the MDLs in the method blanks, except for the following:

Method Blank ID	Analyte	Detection in Blank (µg/kg)	Affected Sample	Original Result (µg/kg)	Adjusted Results (µg/kg)
KWG1002463-MB	Dimethyl Phthalate	2.3 J	T115SG01A100310 T115SG03A100310 T115SG04A100310	2.6 J 1.5 J 1.1 J	5.8 U 5.8 U 5.5 U

Note: J – The value was at a level between the MDL and MRL, and considered as estimated.

1.6 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate percent recovery (%R) values were within the laboratory control limits.

1.7 Matrix Spike and Matrix Spike Duplicate (MS/MSD)

MS/MSD analyses were to be performed on sample T115SG02A100310. The extraction for the MSD was unsuccessful due to the GPC instrument malfunction. %R values were within the laboratory control limits for the MS. The analytical precision was evaluated based on the LCS/LCSD results (see Section 1.8).

1.8 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed with each analytical batch. All %R and relative percent difference (RPD) values met the laboratory control limits.

1.9 Internal Standards

The method requires that (1) internal standard retention time be within ±30 seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within –50% to +100% of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

1.10 Target Compound Identification

Target compound identification is evaluated by examining if (1) the RRT is within ±0.06 RRT units of the standard RRT for a positively identified compound, (2) the relative intensity of characteristic ions are within ±30% in comparison with the reference spectrum, and (3) ions of a positively identified compound with >10% relative abundance should be present. No anomalies were found. Hexachlorophene results were determined using tentative identification compound search. The compound was not detected in any of the samples, and were qualified (UJ) due to the lack of calibration and QC measurements.

1.11 Compound Quantitation and Method Reporting Limits

The sample-specific MRLs were adjusted with sample amount extracted and supported with adequate initial calibration concentrations. The QAPP requirements for MRLs were achieved.

Verification calculations were performed on 10% of the instrument calibration, calibration verifications, and reported QC and sample analyses. No anomalies were found. Sample quantitation and reporting was correctly performed.

1.12 System Performance

The system performance and stability over an analytical sequence was evaluated by examining chromatograms for abrupt baseline shifting, excessive baseline rise at elevated temperature, progressing peak tailing, or loss of resolution. In addition, the internal standard retention times and response areas were checked for trends of shifting. No anomalies were observed.

1.13 Field Duplicates

Samples T115SG01A100310 and T115SG51A100310 were field duplicates. The results and data qualification are presented in **Appendix A** in the end of this report.

1.14 Overall Assessment of Data Usability

SVOCs data are of known quality and acceptable for use, as qualified.

2. Polychlorinated Dioxins/Furans by HRGC/HRMS (EPA Method 1613B)

2.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

EPA Method 1613B recommends a holding time of one year for solid samples stored in the dark at <-10°C. The NFG recommended that extracts be analyzed within 30 days of extraction. The sample was extracted and analyzed within the recommended holding times.

2.2 HRGC/HRMS Instrument Performance Check

The NFG and EPA Method 1613B criteria for instrument performance checks are as follows:

Mass Spectrometer Resolution: (1) The resolution check should be performed prior to initial calibration and at the start and end of each 12-hour shift, (2) the resolution should be ≥ 10,000 resolving power at m/z 304.9824, and (3) the deviation between the exact m/z and the theoretical m/z must be less than 5 ppm for monitored isomers.

Window Defining Mixture (WDM) and Column Performance Solution (CPS): (1) WDM and CPS should be analyzed prior to initial calibration and continuing calibration verification, and (2) the 2,3,7,8-TCDD peak and 1,2,3,8-TCDD peak should be resolved with a valley of ≤ 25%.

All HRGC/HRMS instrument performance checks met the criteria.

2.3 Initial Calibration

The NFG and EPA Method 1613B criteria for initial calibration are as follows:

(1) A minimum of five standards should be employed,
(2) The percent relative standard deviation (%RSD) of isomer response should be <20% for native compounds and <35% for labeled compounds,
(3) The absolute RT of the internal standard $^{13}C_{12}$-1,2,3,4-TCDD must be >25 minutes on the DB-5 (or equivalent) column and >15 minutes on the DB-225 (or equivalent) column,
(4) The ion abundance ratios should be within the control limits listed in EPA Method 1613B, Table 9, and
(5) The signal-to-noise (S/N) ratio should be >10 for all native and labeled compounds in the first calibration standard (CS1).

Initial calibrations met all acceptance criteria.

2.4 Calibration Verification

The NFG and EPA Method 1613B criteria require that:

(1) Continuing calibration verifications be performed at the beginning of each 12-hour shift,
(2) The percent difference (%D) value be within the control limits listed in EPA Method 1613B, Table 6, and
(3) The ion abundance ratios, retention times, relative retention times, instrument sensitivity should meet the same criteria as for initial calibrations.

All calibration verification analyses met the criteria.

2.5 Blanks

Method Blank: A method blank was prepared and analyzed as required for each preparation batch. No target analytes were detected at or above the estimated detection limits (EDLs), except for the following:

Method Blank ID	Analyte	Detection in Blank (ng/kg)	Affected Sample	Original Result (ng/kg)	Adjusted Result (ng/kg)
EQ10000128-01	1,2,3,4,6,7,8-Heptachlorodibenzo-*p*-dioxin (HpCDD)	0.242 J	T115SG01A100310 T115SG02A100310 T115SG51A100310	4.88 J 5.61 J 4.53 J	5.63 U 5.64 U 6.01 U
EQ10000128-01	Octachlorodibenzo-*p*-dioxin (OCDD)	1.62 J	All sample concentrations were >10x the detection in method blank.	--	--

Method Blank ID	Analyte	Detection in Blank (ng/kg)	Affected Sample	Original Result (ng/kg)	Adjusted Result (ng/kg)
EQ10000128-01	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	0.0754 J	T115SG01A100310 T115SG02A100310 T115SG03A100310 T115SG04A100310 T115SG51A100310	0.807 J 0.873 J 2.88 J 1.63 J 0.654 J	5.63 U 5.64 U 5.09 U 5.06 U 6.01 U
EQ10000128-01	Octachlorodibenzofuran (OCDF)	0.211 J	T115SG01A100310 T115SG02A100310 T115SG04A100310 T115SG51A100310	2.33 J 2.92 J 4.74 J 2.07 J	11.3 U 11.3 U 10.1 U 12 U

Note: J – The value was at a level between the EDL and MRL, and considered as estimated.

2.6 Initial Precision and Recovery Study (IPR) and Ongoing Precision and Recovery (OPR)

The initial precision and recovery study was performed according to the laboratory, but results were not provided in the data package. A laboratory control sample (LCS) was analyzed in lieu of ongoing precision and recovery (OPR) analysis (see Section 3.8).

2.7 Labeled Compounds

Fifteen labeled compounds were added to all field and laboratory QC samples as required by the method. The percent recovery (%R) values met the method requirements (EPA Method 1613B, Table 7).

2.8 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed as required by the method. All %R and relative percent difference (RPD) values met the laboratory control limits,

2.9 Matrix Spike and Matrix Spike Duplicate (MS/MSD)

MS/MSD analyses were performed on sample T115SG02A100310 as requested. All %R and RPD values met the laboratory control criteria, except for the following:

Analyte	% R		%R Control Limit	RPD	RPD Criterion	Affected Sample	Data Qualifier
	MS	MSD					
Octachlorodibenzo-*p*-dioxin (OCDD)	76%	229%	78-144%	100%	50%	T115SG02A100310	**J**

2.10 Target Compound Identification

Target compound identification was evaluated by examining if:

(1) the signals for the two exact m/z's being monitored were present, and maximized within ±2 seconds of one another;
(2) the S/N ratio of each of the two exact m/z's must be greater than or equal to 2.5;
(3) the ion abundance ratios were within the method control limits (EPA Method 1613B, Table 9); and
(4) the relative retention time (RRT) or retention time (RT) of the peaks were within the method control limits (EPA Method 1613B, Table 2).

All reported target analyte detections were properly identified.

2.11 Method Reporting Limits (MRLs) and Compound Quantitation

Correct internal standards, quantitation ions, and average RFs were used to quantitate target compound detections. The MRLs were supported with adequate ICAL calibration concentrations. Sample-specific EDLs and MRLs were adjusted with sample weights, internal standard peak height, and noise levels as required by the method.

Concentrations of octachlorodibenzo-*p*-dioxin (OCDD) in samples T115 SC0532 100310ZA and T115 SC043 100310ZA exceeded the instrument calibration ranges. The results were qualified (J) as estimated.

A verification calculation was performed on 10% of the reported calibration, laboratory QC analyses, and sample results. No anomalies were found.

2.12 Second Column Confirmation

Second-column confirmation is required for samples analyzed on a DB-5 (or equivalent) column in which 2,3,7,8-TCDF is reported at or above the EDL, or where 2,3,7,8-TCDF is reported as an Estimated Maximum Possible Concentration (EMPC). 2,3,7,8-TCDF was detected in all samples and confirmed on the DB-225 column. The 2,3,7,8-TCDF values were reported from the DB-225 column as required.

2.13 Field Duplicates

Samples T115SG01A100310 and T115SG51A100310 were field duplicates. The results and data qualification are presented in **Appendix A** in the end of this report.

2.14 Overall Assessment of Polychlorinated Dioxins/Furans Data Usability

Polychlorinated dioxins and furans data were of known quality and acceptable for use as qualified.

3. Total Organic Carbon (TOC) and Grain Size

3.1 Holding Times

Sediment samples should be analyzed within 28 days of collection for TOC and 6 months for grain size. All samples were analyzed within the required holding times.

3.2 Method Blank

Method blanks were prepared and analyzed for TOC as required. TOC was not detected at or above the RLs in the method blanks.

3.3 Replicate Analysis

Triplicate analyses were performed for TOC and grain size on sample T115SG02A100310. All %RSD values were within the acceptance criterion (20%).

3.4 Laboratory Control Sample (LCS)

The LCS analysis for TOC was performed as required by the method. All %R values were within the laboratory control limits.

3.5 Matrix Spike (MS)

TOC matrix spike analysis was performed on sample T115SG02A100310. The %R value was within the laboratory control criterion (75 – 125%).

3.6 Field Duplicates

Samples T115SG01A100310 and T115SG51A100310 were field duplicates. The results and data qualification are presented in **Appendix A** in the end of this report.

3.7 Overall Assessment of TOC and Grain Size Data Usability

TOC and grain size data are of known quality and acceptable for use.

SUMMARY

Data qualification and reasons are summarized as follows:

Sample ID	Analyte	Data Qualifier	Reason	Report Section
T115SG02A100310	Octachlorodibenzo-*p*-dioxin (OCDD)	**J**	MS/MSD %R and RPD values were outside the control limits.	**2.9**

Data affected by associated blanks are qualified and results adjusted as follows:

Sample ID	Analyte	Original Result	Adjusted Result	Unit	Report Section
T115SG01A100310 T115SG02A100310 T115SG51A100310	Dimethyl Phthalate	4.88 J 5.61 J 4.53 J	**5.63 U** **5.64 U** **6.01 U**	**µg/kg**	**1.5**
T115SG01A100310 T115SG02A100310 T115SG03A100310 T115SG04A100310 T115SG51A100310	Octachlorodibenzo-*p*-dioxin (OCDD)	0.807 J 0.873 J 2.88 J 1.63 J 0.654 J	**5.63 U** **5.64 U** **5.09 U** **5.06 U** **6.01 U**	**ng/kg**	**2.5**
T115SG01A100310 T115SG02A100310 T115SG04A100310 T115SG51A100310	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	2.33 J 2.92 J 4.74 J 2.07 J	**11.3 U** **11.3 U** **10.1 U** **12 U**	**ng/kg**	**2.5**
T115 SC032 100310ZD T115 SC042 100310ZB	Octachlorodibenzofuran (OCDF)	1.11 J 0.256 J	**11.7 U** **11.2 U**	**ng/kg**	**2.5**

Data Qualifiers are defined as follows:

Data Qualifier	Definition
J	The analyte was detected above the reported quantitation limit, and the reported concentration was an estimated value.
R	The result was rejected and could not be used.
U	The analyte was analyzed for, but was considered not detected at the reporting limit or reported value.
UJ	The analyte was analyzed for, and the associated quantitation limit was an estimated value.

Approved By: _____ Date: _____

Mingta Lin

REFERENCES

USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, Office of Superfund Remediation and Technology Innovation, U.S. Environmental Protection Agency, June 2008, EPA-540-R-08-01.

USEPA Analytical Operations/Data Quality Center National Functional Guidelines for Chlorinated Dioxin/Furan Data Review, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, September 2005, EPA 540/R-05-001.

USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, December 1996.

USEPA Method 1613 Tetra- Through Octa-Chlorinated Dioxins and Furans by Isotope Dilution HRGC/HRMS, October 1994.

USEPA Region 10 Standard Operating Procedure for the Validation of Polychlorinated Dibenzo-p-dioxin (PCDD) and Polychlorinated Dibenzo-furan (PCDF) Data, January 1996.

Recommended Protocols for Measuring Conventional Sediment Variables in Puget Sound, Puget Sound Water Quality Authority, March 1986.

Recommended Guidelines for Measuring Organic Compounds in Puget Sound Water, Sediment and Tissue Samples, Puget Sound Water Quality Authority, April 1997.

Port of Seattle, Terminal 115 Sand Cover Monitoring Plan, Anchor QEA, LLC., June 2009.

Appendix A

Field duplicate RPD is indicative of field and laboratory precision and sample homogeneity in combination. The precision criterion of 50% specified in the QAPP was applied to evaluating the RPD values of soil field duplicate results ≥5xMRL. For results that are <5xMRL, an advisory criterion of ±2xMRL was applied to evaluating the concentration differences. The RPD (or concentration difference as applicable) values and data qualification for detected compounds in field duplicates are presented as follows:

Analytes	MRL	Unit	Sample ID & Results		RPD (%) or Difference	Data Qualification
			T115SG01A100310	T115SG51A100310		
Solids, Total	0.1	%	86.3	86.4	0%	-
Carbon, Total Organic (TOC)	0.05	%	0.068	0.173	0.105%	
Gravel	0.1	%	10.3	10.5	2%	-
Sand, Very Coarse	0.1	%	9.85	12.6	24%	-
Sand, Coarse	0.1	%	19.4	21.5	10%	-
Sand, Medium	0.1	%	26.3	27.3	4%	-
Sand, Fine	0.1	%	22.5	19.7	13%	-
Sand, Very Fine	0.1	%	6.28	5.02	22%	-
Silt	0.1	%	2.17	1.72	23%	-
Clay	0.1	%	0.88	0.85	3%	-
Dimethyl Phthalate	5.8	µg/kg	2.6 BJ	ND	2.6 µg/kg	
Fluoranthene	2.9	µg/kg	3.7	5.2	1.5 µg/kg	
Pyrene	2.9	µg/kg	4.3	6.2	1.9 µg/kg	
Benz(a)anthracene	2.9	µg/kg	ND	2.2 J	2.2 µg/kg	
Chrysene	2.9	µg/kg	3.1	3.7	0.6 µg/kg	
Bis(2-ethylhexyl) Phthalate	58	µg/kg	8.4 J	8.6 J	0.2 µg/kg	
Benzo(b)fluoranthene	2.9	µg/kg	3.5	4.1	0.6 µg/kg	
Benzo(a)pyrene	2.9	µg/kg	2.1 J	2.4 J	0.3 µg/kg	
Indeno(1,2,3-cd)pyrene	2.9	µg/kg	ND	1.6	1.6 µg/kg	
Benzo(g,h,i)perylene	2.9	µg/kg	1.6 J	ND	1.6 µg/kg	
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	5.63	ng/Kg	0.0394 J	ND	0.0394 ng/Kg	
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	5.63	ng/Kg	0.171 J	0.2 J	0.029 ng/Kg	
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	5.63	ng/Kg	4.88 J	4.53 J	0.35 ng/Kg	
Octachlorodibenzo-p-dioxin (OCDD)	11.3	ng/Kg	45.2 B	38.5 B	6.7 ng/Kg	

1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	5.63	ng/Kg	0.244 J	0.153 J	0.091 ng/Kg	
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	5.63	ng/Kg	0.073 J	0.0733 J	0.0003 ng/Kg	
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	5.63	ng/Kg	0.807 BJ	0.654 BJ	0.153 ng/Kg	
Octachlorodibenzofuran (OCDF)	11.3	ng/Kg	2.33 BJ	2.07 BJ	0.26 ng/Kg	

Note: J – The value is between the MDL and RL and considered estimated. B – The analyte was also detected in method blank.